COMTECH
EF DATA ™

SMS-458B

Modem Protection Switch
Installation and Operation Manual

Part Number MN/SMS458B. IOM   Revision 2

SMS-458B

Modem Protection Switch
Installation and Operation Manual

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Tempe, Arizona 85281 USA

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3. Ship the product back to Comtech EF Data. (Shipping charges should be prepaid.)

For more information regarding the warranty policies, see Warranty Policy, p. xiii

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About this Manual

This manual provides installation and operation information for the Comtech EF Data SMS-458B Modem Protection Switch. This a technical document intended for earth station engineers, technicians, and operators responsible for the operation and maintenance of the SMS-458B..

Related Documents

The following documents are referenced in this manual:

- Department of Defense (DOD) MIL-188-114A, "Electrical Characteristics of Digital Interface Circuits"

- Comtech EF Data, *SDM2020 Modulator, Rev. 4 dated, September 15, 1999 Installation and Operation Manual*

- Comtech EF Data, *SDM-9000, Rev. 4, dated, May 5, 1997 Installation and Operation Manual*

Conventions and References

Cautions and Warnings

⚠ CAUTION

CAUTION indicates a hazardous situation that, if not avoided, may result in minor or moderate injury. CAUTION may also be used to indicate other unsafe practices or risks of property damage.

✋ WARNING

WARNING indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.

❗ IMPORTANT

IMPORTANT indicates a statement that is associated with the task being performed.

Metric Conversion

Metric conversion information is located on the inside back cover of this manual. This information is provided to assist the operator in cross-referencing English to Metric conversions.

Recommended Standard Designations

Recommended Standard (RS) Designations have been superseded by the new designation of the Electronic Industries Association (EIA). References to the old designations are shown only when depicting actual text displayed on the screen of the unit (RS-232, RS-485, etc.). All other references in the manual will be shown with the EIA designations (EIA-232, EIA-485, etc.) only.

Trademarks

Other product names mentioned in this manual may be trademarks or registered trademarks of their respective companies and are hereby acknowledged.

Reporting Comments or Suggestions Concerning this Manual

Comments and suggestions regarding the content and design of this manual will be appreciated. To submit comments, please contact the Comtech EF Data Customer Support Department.

Overview of Changes Made to Revision 1

ELECTRICAL SAFETY

The SMS-458B Modem Protecrtion Switch has been shown to comply with the following safety standard:

- EN 60950: Safety of Information Technology Equipment, including electrical business machines.

The equipment is rated for operation over the range 90 to 264 volts AC. It has a maximum power consumption of 160 watts.

FUSES

The SMS-458B Modem Protecrtion Switch is fitted with two fuses, one each for line and neutral connections. These are contained within the body of the IEC power connector, behind a small plastic flap.

- For 230 volt AC operation, use T0.75A, 20mm fuses.
- For 115 volt AC operation, use T1.25A fuses, 20mm fuses.

IMPORTANT

For continued operator safety, always replace the fuses with the correct type and rating.

Environmental

The SMS-458B Modem Protecrtion Switch must not be operated in an environment where the unit is exposed to extremes of temperature outside the ambient range 0 to 50°C (32 to 122°F), precipitation, condensation, or humid atmospheres above 95% RH, altitudes (un-pressurized) greater than 2000 meters, excessive dust or vibration, flammable gases, corrosive or explosive atmospheres.

Operation in vehicles or other transportable installations that are equipped to provide a stable environment is permitted. If such vehicles do not provide a stable environment, safety of the equipment to EN60950 may not be guaranteed.

Installation

The installation and connection to the line supply must be made in compliance to local or national wiring codes and regulations.

The SMS-458B Modem Protecrtion Switch is designed for connection to a power system that has separate ground, line and neutral conductors. The equipment is not designed for connection to power system that has no direct connection to ground.

The SMS-458B Modem Protecrtion Switch is shipped with a line inlet cable suitable for use in the country of operation. If it is necessary to replace this cable, ensure the replacement has an equivalent specification. Examples of acceptable ratings for the cable include HAR, BASEC and HOXXX-X. Examples of acceptable connector ratings include VDE, NF-USE, UL, CSA, OVE, CEBEC, NEMKO, DEMKO, BS1636A, BSI, SETI, IMQ, KEMA-KEUR and SEV.

International Symbols:

Symbol	Definition
∼	Alternating Current
⊏▭⊐	Fuse
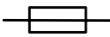
Symbol	Definition
⏚	Protective Earth
⏚	Chassis Ground

Telecommunications Terminal Equipment Directive

In accordance with the Telecommunications Terminal Equipment Directive 91/263/EEC, this equipment should not be directly connected to the Public Telecommunications Network.

EMC (Electromagnetic Compatibility)

In accordance with European Directive 89/336/EEC, the SMS-458B Modem Protecrtion Switch has been shown, by independent testing, to comply with the following standards:

Emissions: EN 55022 Class B - Limits and methods of measurement of radio interference characteristics of Information Technology Equipment.

    (Also tested to FCC Part 15 Class B)

Immunity: EN 50082 Part 1 - Generic immunity standard, Part 1: Domestic, commercial and light industrial environment.

Additionally, the SDM-2020D has been shown to comply with the following standards:

EN 61000-3-2	Harmonic Currents Emission
EN 61000-3-3	Voltage Fluctuations and Flicker
EN 61000-4-2	ESD Immunity
EN 61000-4-4	EFT Burst Immunity
EN 61000-4-5	Surge Immunity
EN 61000-4-6	RF Conducted Immunity
EN 61000-4-8	Power frequency Magnetic Field Immunity
EN 61000-4-9	Pulse Magnetic Field Immunity
EN 61000-4-11	Voltage Dips, Interruptions, and Variations Immunity
EN 61000-4-13	Immunity to Harmonics

IMPORTANT

In order that the Modem continues to comply with these standards, observe the following instructions:

- Connections to the transmit and receive IF ports (Type N and Type F, female, connectors) should be made using a good quality coaxial cable - for example RG58/U (50Ω) or RG59/U (75Ω).

- All 'D' type connectors attached to the rear panel must have back-shells that provide continuous metallic shielding. Cable with a continuous outer shield (either foil or braid, or both) must be used, and the shield must be bonded to the back shell.

- The equipment must be operated with its cover on at all times. If it becomes necessary to remove the cover, the user should ensure that the cover is correctly re-fitted before normal operation commences.

Warranty Policy

This Comtech EF Data product is warranted against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, Comtech EF Data will, at its option, repair or replace products that prove to be defective.

For equipment under warranty, the customer is responsible for freight to Comtech EF Data and all related custom, taxes, tariffs, insurance, etc. Comtech EF Data is responsible for the freight charges **only** for return of the equipment from the factory to the customer. Comtech EF Data will return the equipment by the same method (i.e., Air, Express, Surface) as the equipment was sent to Comtech EF Data.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from improper installation or maintenance, abuse, unauthorized modification, or operation outside of environmental specifications for the product, or, for damages that occur due to improper repackaging of equipment for return to Comtech EF Data.

No other warranty is expressed or implied. Comtech EF Data specifically disclaims the implied warranties of merchantability and fitness for particular purpose.

Exclusive Remedies

The remedies provided herein are the buyer's sole and exclusive remedies. Comtech EF Data shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Disclaimer

Comtech EF Data has reviewed this manual thoroughly in order that it will be an easy-to-use guide to your equipment. All statements, technical information, and recommendations in this manual and in any guides or related documents are believed reliable, but the accuracy and completeness thereof are not guaranteed or warranted, and they are not intended to be, nor should they be understood to be, representations or warranties concerning the products described. Further, Comtech EF Data reserves the right to make changes in the specifications of the products described in this manual at any time without notice and without obligation to notify any person of such changes.

If you have any questions regarding your equipment or the information in this manual, please contact the Comtech EF Data Customer Support Department.

Chapter 1. INTRODUCTION

This chapter describes the SMS-458B Modem Protection Switch (Figure 1-1), referred to in this manual as "the switch,".

1.1 Overview

The SMS-458B Modem Protection Switch is a rack-mounted unit that provides independent backup control for modulators and demodulators, or simultaneous modulator and demodulator (modem) switching. The switch limits the loss of communication if a primary modem element failure occurs.

Figure 1-1. SMS-458B

1.2   **Purpose and Function**

The switch is a fully-automated, self-contained, switching unit for the following equipment:

- SDM-2020 (Modulator) Satellite Modem
- SDM-2020 (Demodulator) Satellite Modem
- SDM-9000 Satellite Modem

The switch is designed to interface with ASI, G.703, or compatible data streams.

One backup modem provides redundancy for up to four prime modems. The switch will automatically or manually switch one backup modem to take the place of any of four prime modems.

In normal operation, each prime modem input is fed through to its corresponding IF output, and the backup modems are fed to the offline IF outputs. When a modem fault is detected, the faulted modem is switched offline and re-routed to one of the offline IF outputs. The backup modem is configured identically to the failed modem and is switched in its place, unless the backup modem is already backing up a prime of equal or greater priority.

The switch does not contain an IF signal combining/dividing section, so that the user may externally tailor the combiner/divider loss for a minimum configuration per application.

Figure 1-2 shows the switch interface between the prime and backup modems, the terminal equipment, and IF converter equipment. The switch provides:

- All data and IF switching circuitry
- Complete status and fault reporting
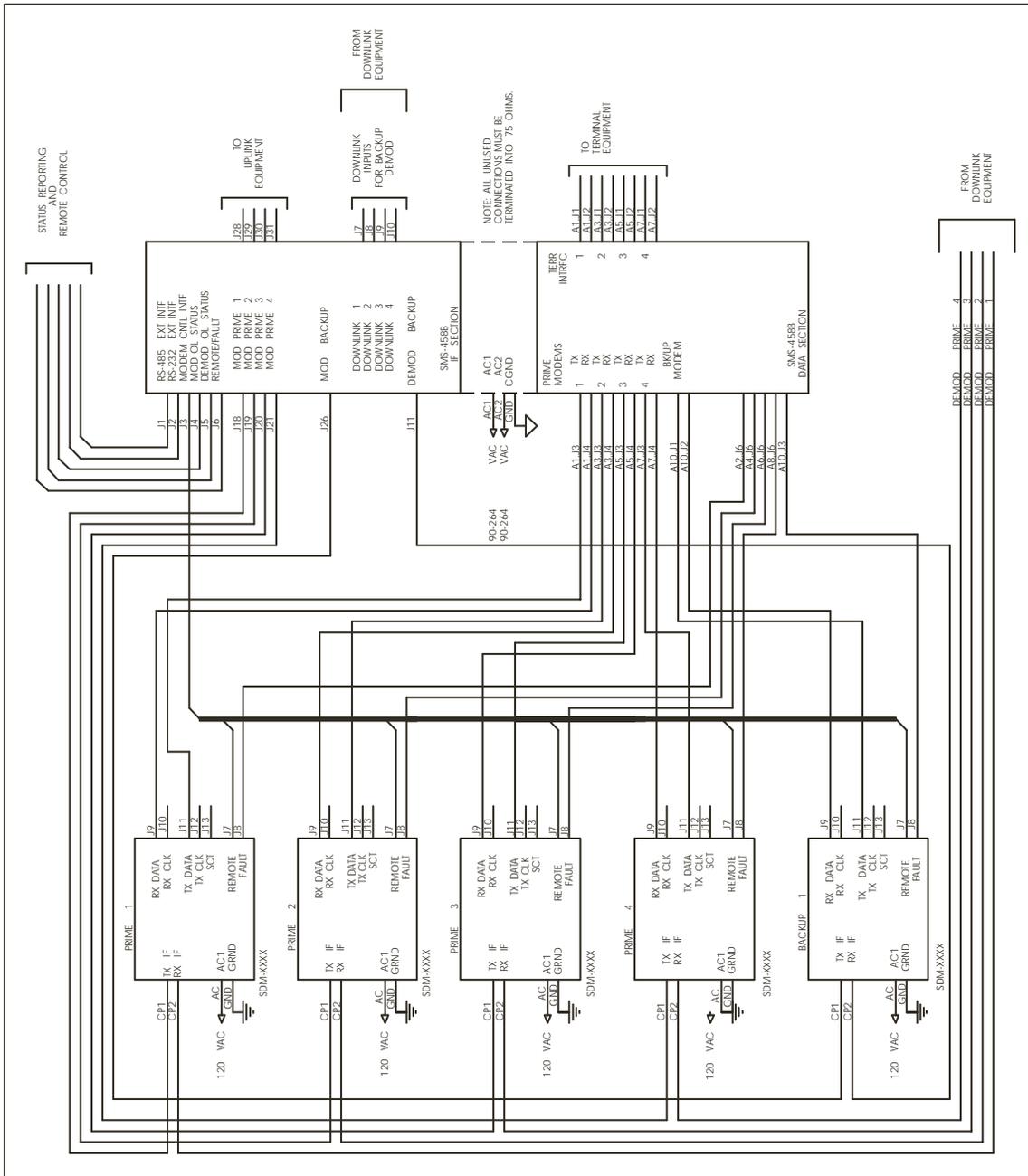
Figure 1-2. System Block Diagram

1.3   Description

The switch is complete and self-contained in a standard 19-inch (48 cm) rack-mounted enclosure weighing approximately 50 lbs (22.68 kg). Modular construction methods were used for ease in replacing modules.

The chassis assembly is segmented with upper and lower chassis-mounted backplanes.

The top section (Figure 1-3) contains:

- Two power supplies and four printed circuit board (PCB) assemblies, providing:

    - Front panel keypad and display accessible from the front panel.

    - Serial remote interfaces, relay-remote/fault, status, and IF connections accessible from the rear panel. Refer to Figure 1-4 for a block diagram of the IF switching matrix.

The lower section (Figure 1-5) contains:

- High-speed data switching matrix and matrix driver.
- Data switch interface modules accessible from the rear.

Refer to Figure 1-6 for the interconnect diagram of the lower section.

The switch contains a microcontroller system. This system controls all switching functions and maintains communication with the modems. It also communicates with an optional external controller. A remote operator can control the switching by using a terminal or computer and the remote serial interface.

Redundant power supplies maintain switch operation even if one power supply fails. The switch and modem configurations are stored in battery-backed memory devices for protection against power loss.
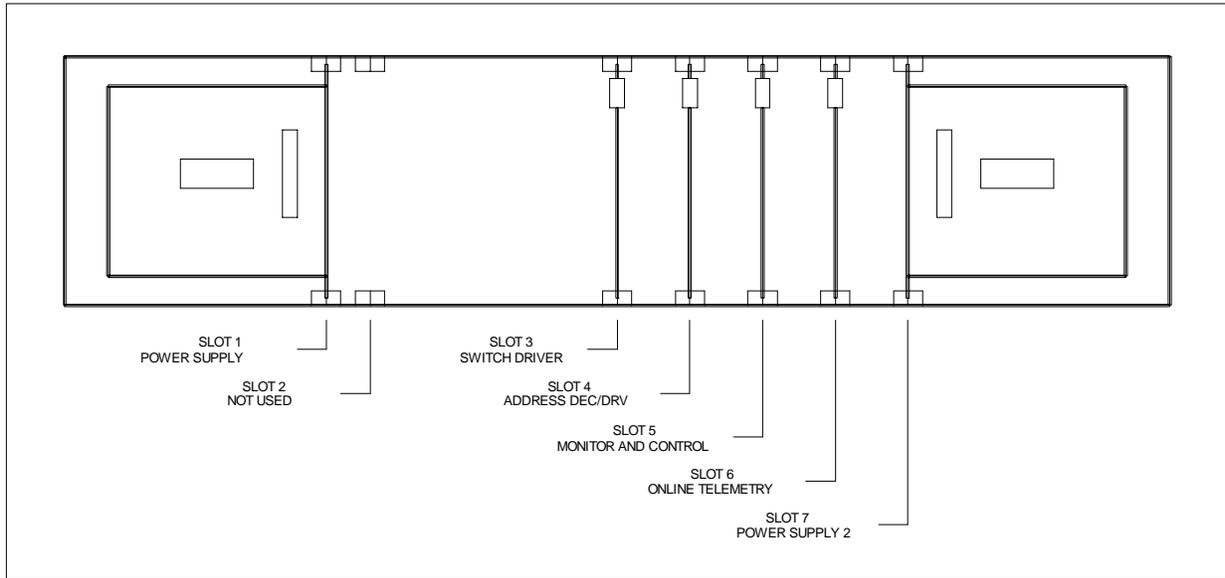
Figure 1-3. SMS-458B Upper-Front Section Interior
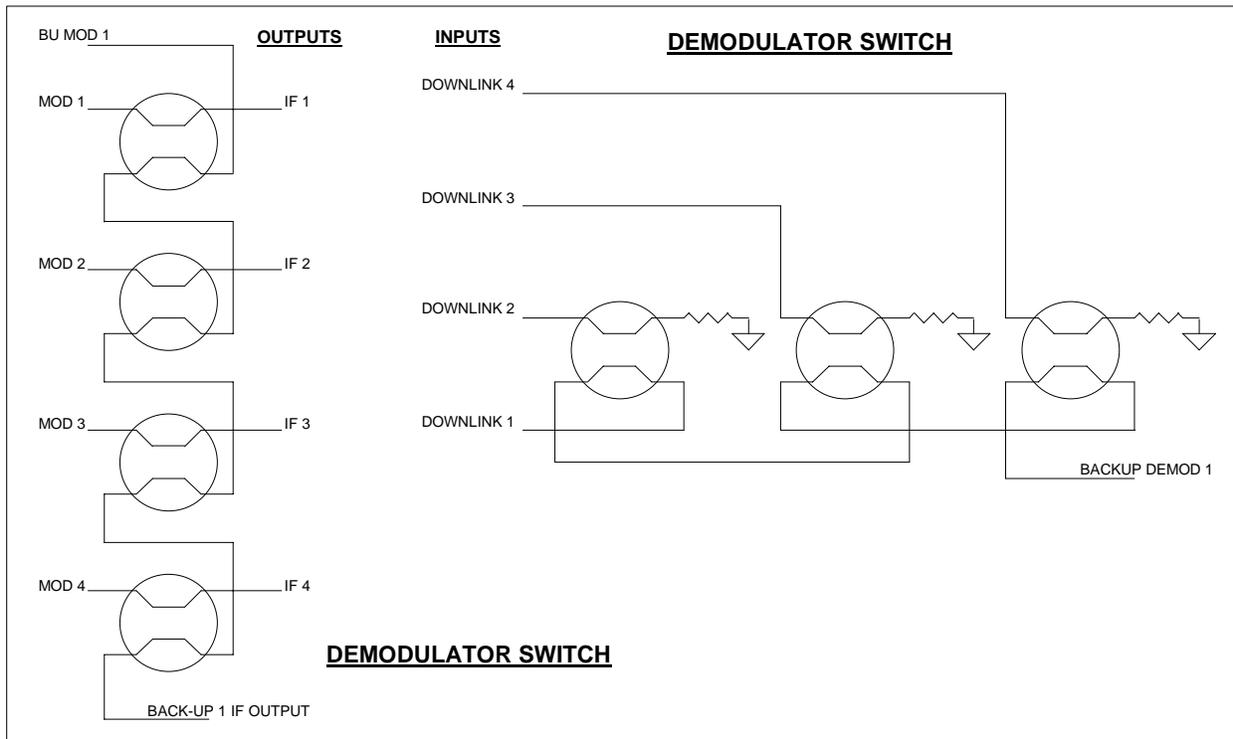
Figure 1-4. SMS-458B IF Switching Matrix
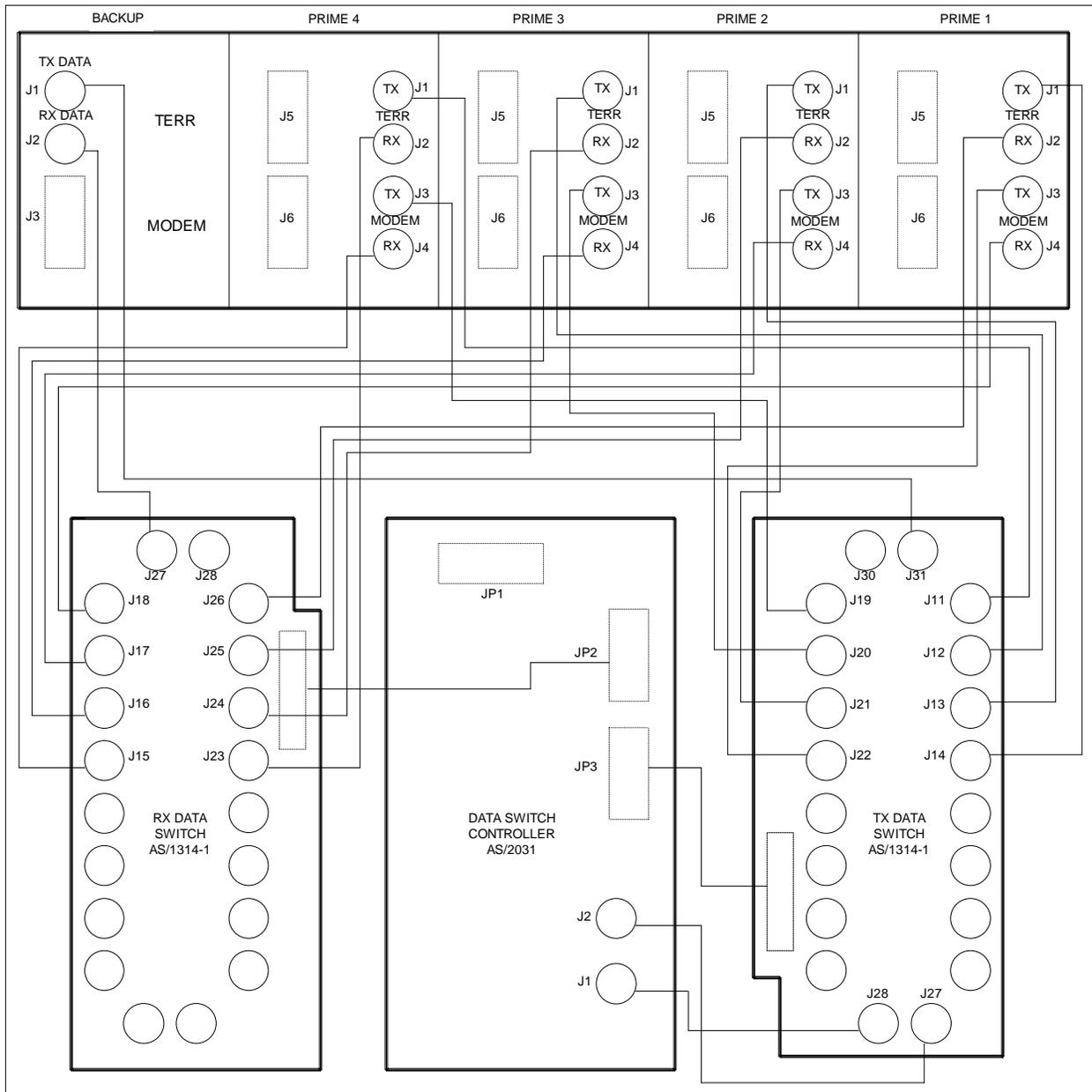
Figure 1-5. Lower Section Interconnect Diagram
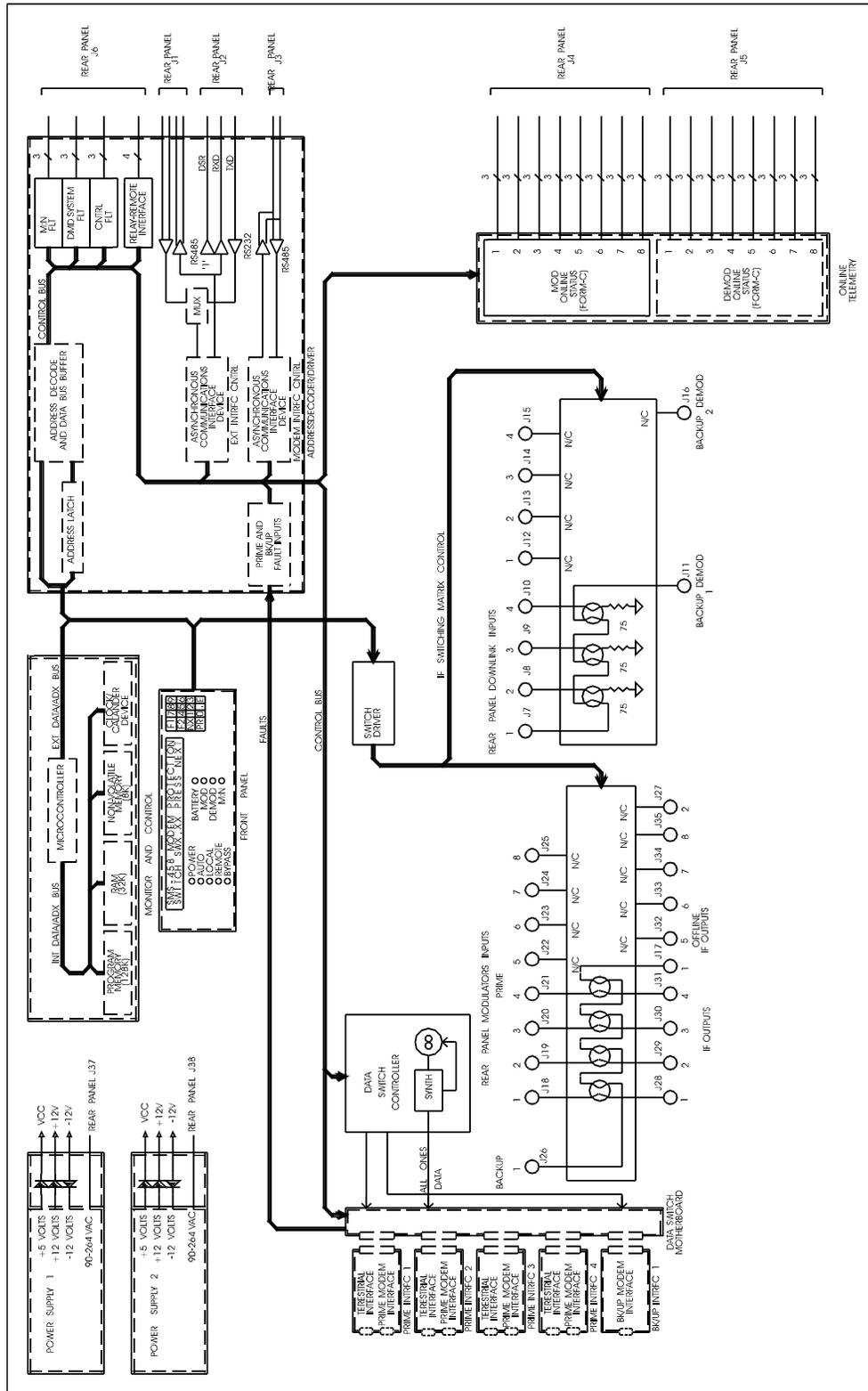
Figure 1-6. SMS-458B Block Diagram

1.4   Major Assemblies

The switch consists of the following assemblies:

Assembly Description	Part No.	QTY
Chassis	AS/2040-1	
Controller Motherboard	AS/1317	
Data Switch Motherboard	AS/2034	
Data Switch Controller	AS/2031	2 each
Monitor and Control	AS/0356	
Address Decoder/Driver	AS/1048	
IF Switch Driver	AS/1316	
IF Switch	AS/1314	
O/L Telemetry	AS/0585	
Display/Keypad	AS/0540	
Power Supply	AS/1508-1	2 each
Prime Interface Switch	AS/2068	up to 4
Backup Interface Switch	AS/2069	1 each

1.5   System Requirements

With all interface switch modules installed, the switch is capable of operation as a 1:4
protection switch (i.e., one full-duplex standby modem can back up four full-duplex
primary modems).

The switch can be configured in any combination including:

- TX only modems
- RX only modems
- Multiple downlinks (limited to 4)

Refer to Section 3.1 for a complete explanation of the configuration function.

1.6   Specification

The operating specifications for the switch are described in Table 1-1.

Table 1-1. SMS-458B Specification

Operation	
Number of Online Modems	Expandable from 1 to 4 with plug-in prime interface switch modules (the modems can be of different data rates as long as the backup modems are compatible).
Number of Backup Modems	1 backup modem with a plug-in backup interface switch module.
Data Interfaces	ASI ECL G.703
Return Loss	> 15 dB.
IF Frequency Response	50 to 180 MHz.
Downlinks	Each demodulator is configurable for 1 of 4 downlink connections.
Prime Modulator to Output Loss	$\leq$ 1 dB
Backup Modulator to Prime Output Loss	$\leq$ 1 dB
Manual Delay Switch-Over Time	Modulator: 0 to 127.0 sec., in 0.5 sec. steps Demodulator: 0 to 127.0 sec., in 0.5 sec. steps
Auto Delay Switch-Over Time	Modulator: < 1 sec Demodulator: < 3 sweep periods of the back-up demodulator.
Switch-over Priority	1 of 3 priority levels independent for each modulator and demodulator (modulators and demodulators may switch simultaneously in certain applications).
Remote Control Interfaces	External control: EIA-485 or EIA-232 Baud rates from 110 to 9600. Parity: Even or Odd. Addresses from 1 to 255.
Batteries	M&C: NiCad, 30-day memory retention. 48 hr. charge time.
Alarm Reporting	Controller Fault Alarm: Form-C relay contact to indicate controller or power supply failure. System Fault Alarm: Form-C relay contact to indicate any non-catastrophic failure. Demodulator Fault Alarm: Form-C relay contact to indicate all demodulators faulted and a probable IF loss.

Table 1-1. SMS-458B Specification (Continued)

Indicators	Front panel LEDs: • Power supply on • Auto mode • Local mode • Remote mode • Bypass mode • Battery fault • Modulator system failure • Demodulator system failure • Controller and power supply fault 48 character display of: • Prime modulator status • Prime demodulator status • Backup demodulator status • Backup modulator status • Active modulators (prime and backup) • Active demodulators (prime and backup) • Modem address • Modem interface • Modem downlink • Modem priority • Modem delay • Modem configuration • Fault menus
Operation Modes	Auto Local Remote Bypass
Controls	Complete control of all M:N functions from the front panel or through the remote interface.
General	
Input Voltage	90 to 264 VAC (-48 Vdc optional).
Line Power	160 W max. with both power supplies operating.
Line Frequency	47 to 63 Hz
Size	19 W x 22D x 12.20H inches (48.2 6W x 55.88 D x 31H cm)
Weight	50 lbs (22.68 kg)

Chapter 2. INSTALLATION

This chapter provides the information reflecting unpacking, external connections, and installation.

2.1   Unpacking

The switch and manual are packaged in preformed reusable foam inside a cardboard carton.

To remove the switch, proceed as follows:

⚠ **CAUTION**   ***Do not use any cutting tool that will extend more than 1 inch into the container and cause damage to the switch.***

1. Cut the tape at the top of the carton and open the flaps.

⚠ **CAUTION**   ***The switch weights 50 lbs. (22.68 kg). Use caution when lifting the switch out of the carton to avoid bodily injury.***

2. Lift off the preformed foam packing and remove the manual and the unit.
3. Save the packing material for reshipment either back to the factory or to another site.
4. Inspect the equipment for damage incurred during shipment.
5. Check the equipment against the packing list shipped with the equipment to ensure that the shipment is complete.

2.2   Rack Installation

Install the switch in the rack (Figure 2-1) as follows:

1. Be sure that all interface switch modules are in their proper positions and are fully seated in the rear backplane.

2. Mount the switch in the customer-selected position in the equipment rack. Secure using eight mounting bolts and washers.

3. Turn front panel knob and open the front panel. Verify that the two power supplies and four circuit modules are properly seated in the upper backplane.

4. Prior to turning on the power switches, read and become familiar with Chapter 3, Front Panel Operation.

5. Turn on each power supply POWER switch located inside the front panel. The power switch is on when the switch is depressed toward the "1" symbol or when the red-side of the switch is exposed.

6. Close the front panel by securing the front panel knob. Configure the switch as described in Chapter 3. Place the switch in the proper mode for operation.

7. Connect all appropriate connectors to the switch rear panel connectors as specified in Appendix A.

8. If any problems occur during installation or operation, refer to Chapter 5 for troubleshooting information.

EQUIPMENT RACK

SMS-458 SWITCH

MOUNTING BOLTS AND WASHERS

MOUNTING BOLTS AND WASHERS
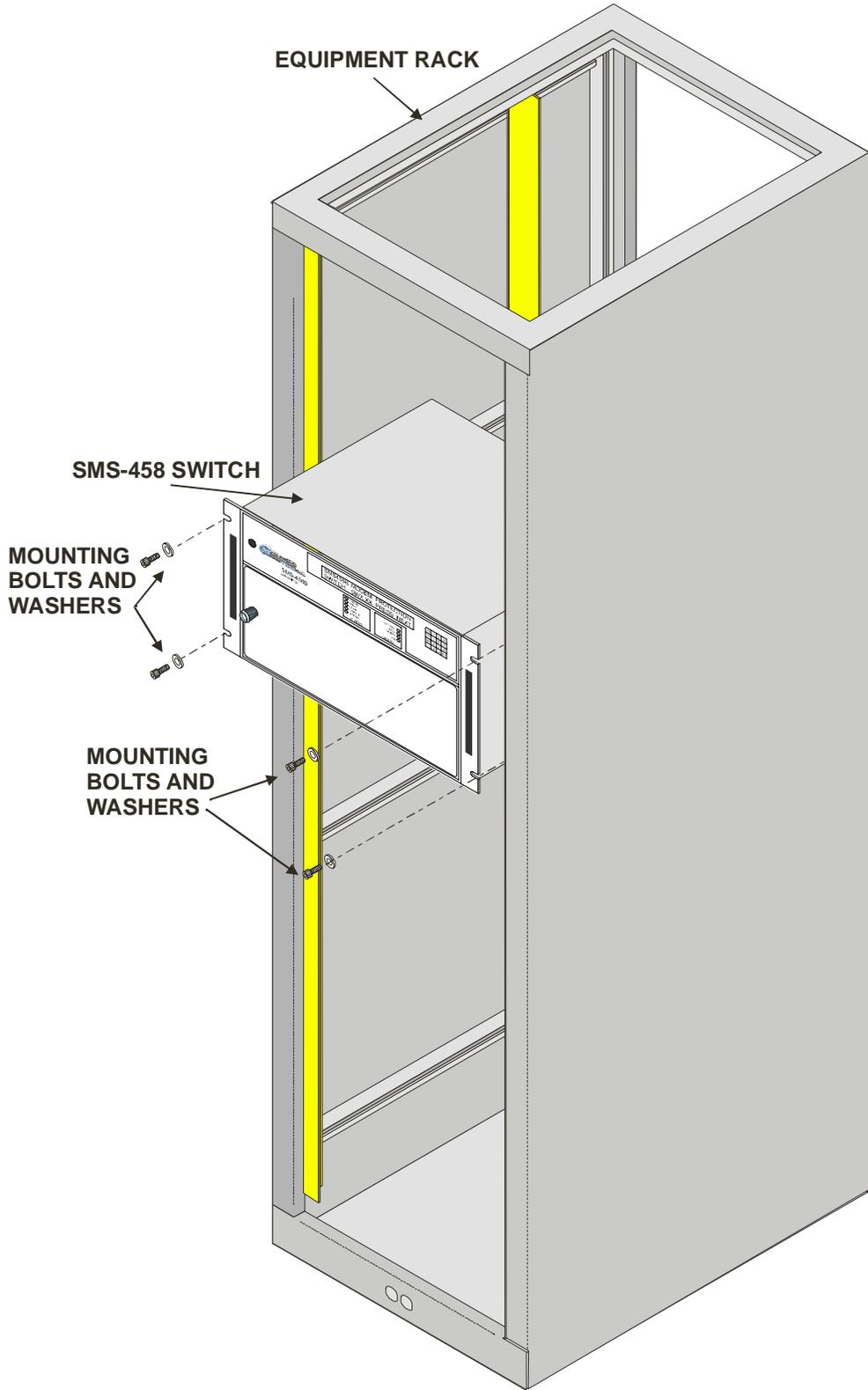
Figure 2-1. Typical Switch Rack Installation

2.3　　　External Connections

All connections between the switch and other equipment are made through rear panel connections. Table 2-1 lists these connectors, and Figure 2-2 shows their locations. The uses of these connectors are described in the following sections.

Table 2-1. Rear Panel Connections

Name	Ref Desig	Connector Type	Function
DATA I/O MODULES	J5, J6 J1 – J4	50-pin D BNC BNC	Mod, Demod Faults G.703, ECL/HSSI, I/O
REMOTE	J1, J2, J3	9-pin D	Remote Interface
ON-LINE STATUS	J4, J5	25-pin D	Online Status Reporting
RELAY/REMOTE FAULTS	J6	25-pin D	Relay/Remote and Faults
DOWNLINK INPUTS	J7 to J10, J12 to J15	BNC	Downlink IF Inputs
BACK-UP DEMODS	J11, J16	BNC	Downlink Outputs to Backup Demods
PRIME MOD INPUTS	J18 to J25	BNC	Modulator IF Inputs
BACK-UP MOD INPUTS	J26, J36	BNC	Backup Mod IF Inputs
OFF-LINE IF OUTPUTS	J17, J27	BNC	Offline Mod IF Outputs
IF OUTPUTS	J28 to J35	BNC	IF Outputs to Uplinks
AC POWER	J37, J38	CEE22	AC Power Input
GROUND	J39	#10-32 stud	Chassis Ground

Note: All unused BNC connectors must have a 75 Ω termination.
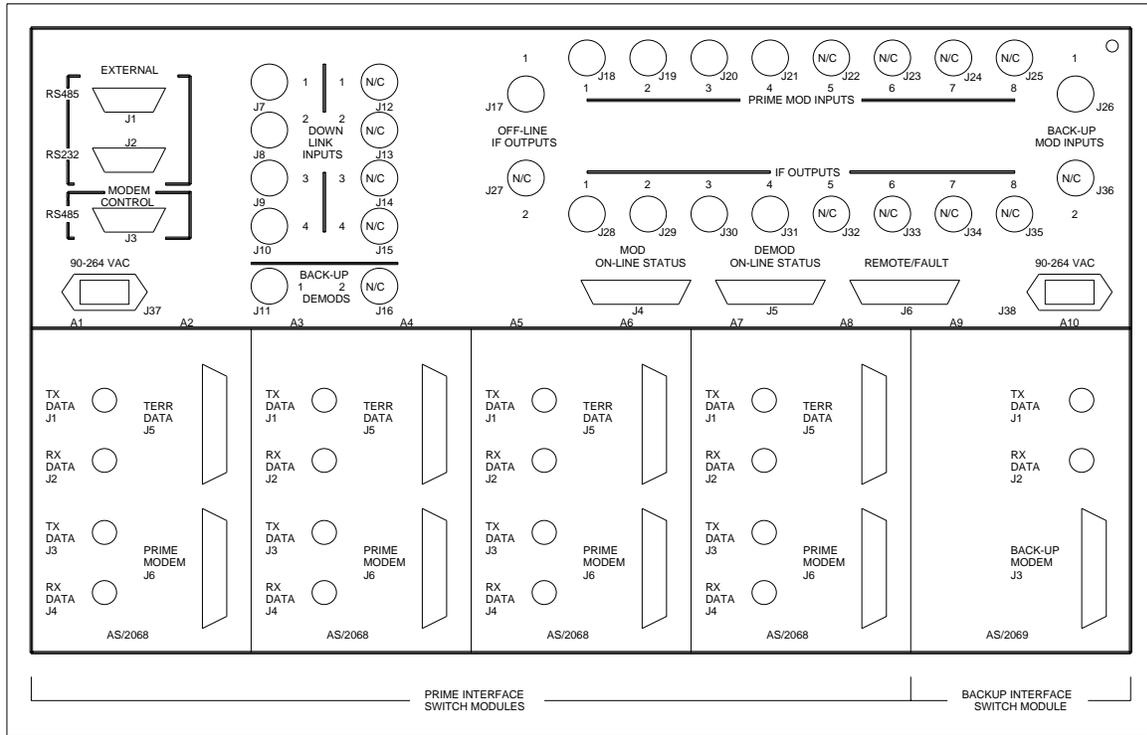
Figure 2-2. SMS-458B Rear Panel View

2.3.1   Data I/O

Connect the Modem and Terrestrial Data I/O to the plug-in interface switch modules in
the lower-rear section of the switch. The interface switch module slots are designated A1
through A10 (left to right, viewed from the rear):

- A1 through A8 are slots for prime interface switch modules 1 through 4
  (1 module for every 2 slots).

- A9 and A10 are the backup module slots (1 module for every 2 slots).

Prime interface switch modules have two sets of connectors:

- Connectors J1, J2, and J5 on the top connect to terrestrial equipment.
- J3, J4, and J6 on the bottom connect to the prime modem.

The backup interface switch module has three connectors designated J1, J2, and J3 for
backup modem connection.

Refer to Section 4.2 for electrical specifications and pinouts of the data connectors.

2.3.2 Remote Interface (J1, J2, J3)

The remote interface connectors provide serial remote interface to the switch.

For external control of the switch, an external controller can connect through J1 (EIA-485) or J2 (EIA-232).

The prime and backup modems connect to the switch through J3 (EIA-485), the modem control interface connector. This connector provides a bus-type control interface, required for system operation.

The remote interfaces connectors are 9-pin female D connectors, with screw locks for mechanical security. The remote connector is a DCE interface.

EIA-485		EIA-232	
Pin #	Name	Pin #	Name
1	GND	1	N/C
2	N/C	2	RD (RX)
3	N/C	3	TD (TX)
4	+RX/TX	4	N/C
5	-RX/TX	5	GND
6	N/C	6	N/C
7	N/C	7	N/C
8	+RX/TX	8	N/C
9	-RX/TX	9	N/C

2.3.3 Online Status (J4, J5)

Connectors J4 and J5 provide the output for the modulator and demodulator backup online status in form-C format.

J4 is for the modulator online status and J5 the demodulator online status.

Two 25-pin female D connectors provide the online status interfaces. Screw locks provide mechanical security for the mating connector.

Pin #	J4 Name	J5 Name
1	Mod 1 COM	Demod 1 COM
2	Mod 1 NC	Demod 1 NC
3	Mod 1 NO	Demod 1 NO
4	Mod 2 COM	Demod 2 COM
5	Mod 2 NC	Demod 2 NC
6	Mod 2 NO	Demod 2 NO
7	Mod 3 COM	Demod 3 COM
8	Mod 3 NC	Demod 3 NC
9	Mod 3 NO	Demod 3 NO
10	Mod 4 COM	Demod 4 COM
11	Mod 4 NC	Demod 4 NC
12	Mod 4 NO	Demod 4 NO
13 to 24	No Connection	No Connection
25	GND	GROUND

2.3.4   Relay-Remote/Fault (J6)

This multi-pin connector provides both input and output signals. The inputs are contact closures or logic level remote control inputs. The outputs are form-C relay contact closure alarms for controller fault, M:N fault, and demodulator system fault.

The relay-remote input and fault status interface connects through a 25-pin female D connector. Screw locks provide mechanical security for the mating connector.

Pin #	Name
1	Controller Fault COM
2	Controller Fault NC
3	Controller Fault NO
4	Relay-Remote Input 0
5	Relay-Remote Input 1
6	Relay-Remote Input 2
7	Relay-Remote Input 3
8	Demodulator Fault COM
9	Demodulator Fault NC
10	Demodulator Fault NO
11	M:N Fault COM
12	M:N Fault NC
13	M:N Fault NO
14 to 24	No Connection
25	Ground

2.3.5 Downlink Inputs (J7 to J10, J12 to J15)

These are the downlink-input connectors. These connections provide the inputs to the downlink-switching matrix.

J7, J8, J9, and J10	Inputs to backup modem 1 **Note:** J12, J13, J14, and J15are not used with this switch.

Up to four downlinks can be connected to the switch. Downlink inputs that are not being used must be terminated into 75 Ω.

2.3.6 Back-Up Demods (J11, J16)

J11 and J16	Outputs from the downlink switching matrix
J11	Backup demod 1 output. It connects to the backup modem RX IF input. **Note:** J16 is not used in this switch

Any of the 4 downlinks can be directed to J11. The default setting is downlink 1. The input frequency range is 50 to 180 MHz, with input impedance of 75Ω. Terminate any back-up demod port into 75Ω when not being used.

2.3.7 Prime Mod Inputs (J18 to J25)

J18 through J25	Prime modulator IF input connections to the modulator IF switching matrix. They connect to the prime modem IF outputs. **Note:** J22 through J25 are not used with this switch.

The input frequency range is 50 to 180 MHz, with input impedance of 75 Ω.

Prime mod inputs that are not being used must be terminated into 75 Ω.

2.3.8 Back-Up Mod Inputs (J26, J36)

J26 and J36	Back-up modulator IF input connectors. They connect to the back-up modem IF outputs. **Note:** J36 is not used in this switch.

The input frequency range is 50 to 180 MHz, with input impedance of 75 Ω.

2.3.9   Offline IF Outputs (J17, J27)

J17 and J27	Offline IF output connectors, used as monitor and test points. **Note:** J27 is not used in this switch.

The outputs of the backup modulators are routed here when not in use.

When backups are online, the offline primes are routed here.

2.3.10   IF Outputs (J28 through J35)

J28 through J35	Modulator IF switching matrix output connections. They connect to the external uplink power combiners. **Note:** J32 through J35 are not used in this switch.

Notes: Observe the following parameters:
1. During normal operation, the prime modulator IF outputs are switched at this location.
2. During a fault condition, the backup modulators IF output will be switched at this location.
3. The frequency range is 50 to 180 MHz, with output impedance of 75Ω.
4. The typical output power level is equal to the modem TX output level, which is from -5 dBm to -20 dBm.
5. Any IF outputs that are not being used must be terminated into 75Ω.

2.3.11   AC Power (J37 and J38)

Applying incorrect input voltage to these connectors can cause severe damage to the switch and will void the product warranty. Verify that the source voltage is correct before connecting the switch.

J37 and J38	Two independent, nonlocking, 3-prong power cords connect AC power to the two power supplies. Normal input voltage is 90 to 264 VAC, at 47 to 63 Hz (-48 $\pm$ 4.8 Vdc are optional). Maximum power consumption is 80 W for each power supply.

2.3.12   Ground

A #10-32 stud is available on the rear panel for connecting the chassis to ground.

Chapter 3. FRONT PANEL OPERATION

This chapter describes the front panel operation of the switch.

3.1 Overview

The switch front panel (Figure 3-1) provides the local interface to configure, operate, and monitor the switch. Proper operation of the switch depends on its proper configuration and setup. The following sections describe the front panel and its operation in detail.

A 48-character, 2-line LCD display in the upper-front panel displays options, and status for the user.

The nine LEDs grouped under the LCD display provide mode and fault status at a glance, and a 16-key keypad to the right allows the user to perform setup, configuration, and operation functions.
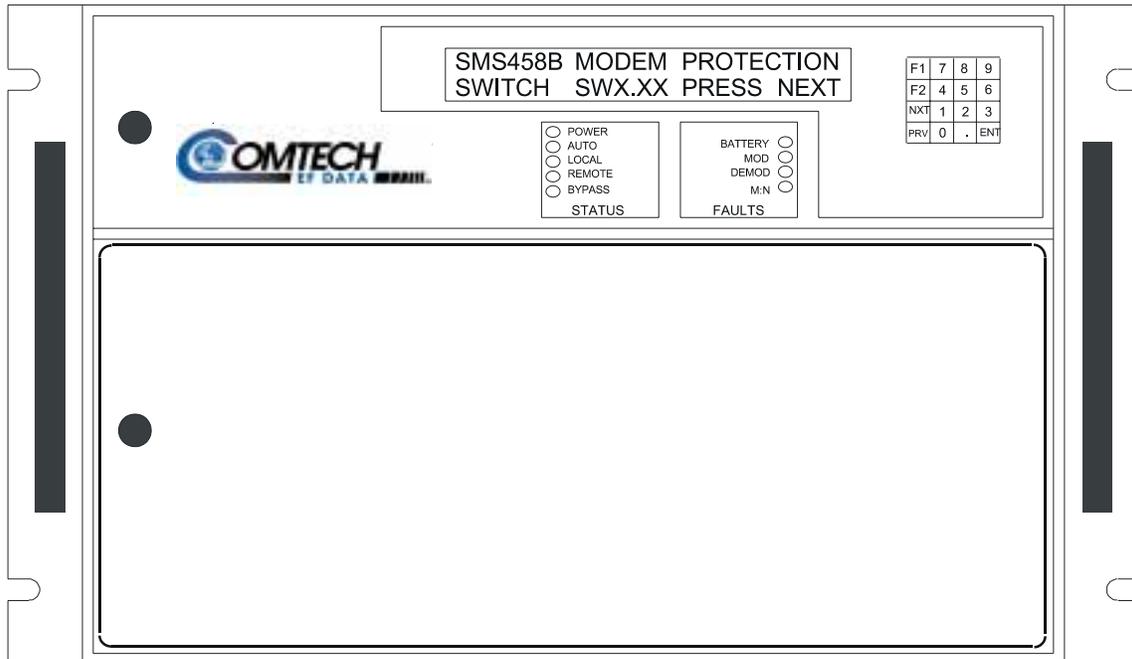
Figure 3-1. SMS-458B Front Panel View

All switch functions are accessible to the user from the front panel through the function keys, [F1] or [F2], the [PREV] key, and the [NEXT] key.

3.2   LED Indicators

Nine LEDs on the front panel indicate the general switch status and summary fault information, as follows:

Faults	
M:N (Red LED)	Lights if M:N fault condition occurs.
MOD (Red LED)	Lights if a modulator operation fault occurs.
DEMOD (Red LED)	Lights if demodulator operation fault occurs.
BATTERY (Red LED)	Lights if one of the battery voltages is low.
STATUS	
POWER ON (Green LED)	Lights when power is applied to the switch.
AUTO (Green LED)	Lights when the switch is in the automatic operating mode.
LOCAL (Green LED)	Lights when the switch is in the local operating mode.
REMOTE (Green LED)	Lights when the switch is in the remote operating mode.
BYPASS (Green LED)	Lights when the switch is in the bypass-operating mode.

3.3   **Keypad and LCD Display**

The keypad and LCD display provide an interface for the local user to access the menus that configure and operate the switch. The keypad includes:

- Numbers 0 through 9
- Decimal
- [ENT]
- [F1] and [F2]
- [NEXT]
- [PREV]

The last four keys specified control the hierarchical menu structure. Menus provide for local setup, configuration, and operation. Each menu contains a portion of the switch control or setup algorithm. Only a limited knowledge of the switch is required, as the menus are self-prompting and all options are displayed.

The base levels of this tree-structured front panel menu are as follows:

- ID menu displayed at power-on
- SYSTEM and MODEM SETUP menu
- MODEM CONFIGURATION menu
- FAULT menu
- MODE menu
- STATUS display

The ID menu displays the version of firmware implemented in the switch.

The [NEXT], [PREV], [F1], [F2], and [ENT] keys control the menus and allow menu selections.

Some display messages have menu options on the right side aligned with the [F1] and [F2] keys. Pressing either of these keys directs the display to the selected menu.

The user can also move forward or backward through the selected menu by pressing the [NEXT] or [PREV] keys.

The switch beeps in response to keypad inputs:

- One beep acknowledges a valid entry with the appropriate action being taken.
- Two beeps indicate that the entry was invalid and no action was taken.

Once the correct menu is selected, the user can press the [ENT] key to enter, change, or view the functions within that menu.

The STATUS display follows the MODE menu. It includes the following:

- Identifies the active modulator and demodulator, both prime and backup.
- Shows backup online status.
- Shows the fault status of both prime and backup modulators and demodulators.

The STATUS menu displays only the active modulators and demodulators. If any modulator or demodulator is faulted, an "F" alternates with the modem number on the display. The display shows online backup modulators and demodulators, with an arrow pointing to the number of the prime being backed-up.

"Hot Standby" mode is identified by a dash between the backup modulator/demodulator and the prime modulator/demodulator.

An asterisk is displayed while the backup modulator/demodulator is in process of backing up a prime modulator/demodulator.

In all modes except BYPASS, the switch returns to the STATUS display returns after approximately three minutes.

Refer to Figure 3-2 for a detailed description of the front panel menu. This figure describes the independent mod/demod switch with support for use with an external buffer/channel unit.

Figure 3-2. Display Map
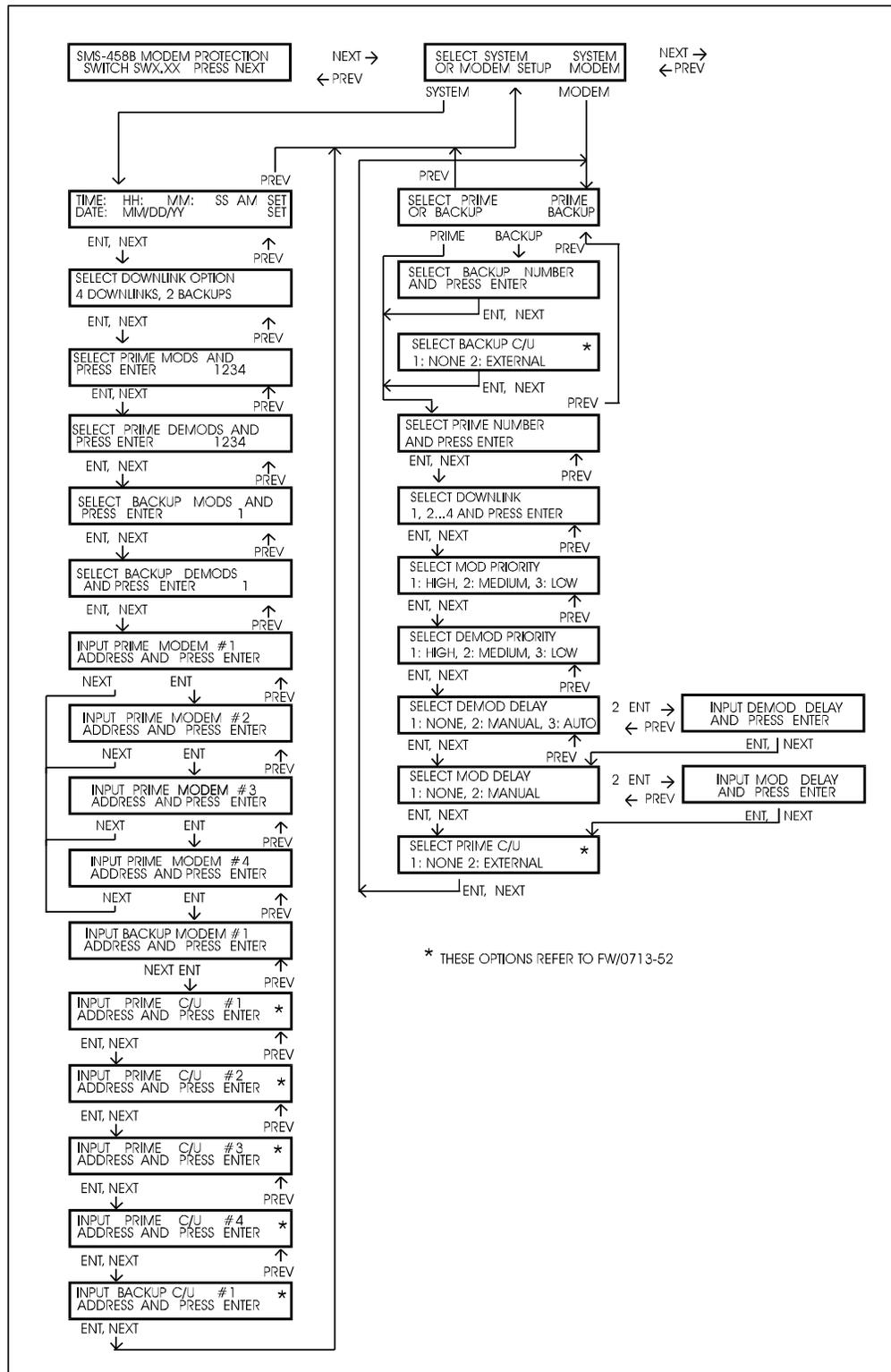
Figure 3-2. Display Map (Continued)

3.4 System and Modem Setup

3.4.1 Prime Uplink and Downlink Ports

J28 through J35	Eight IF outputs available to connect to customer-supplied uplink power combiners. **Note:** Only J28 through J31 are used for this switch.
J7, J8, J9, J10	J7 through J10 are used when four downlink transponders are specified in the system.

The following steps describe the uplink and downlink connections:

1. Connect the IF output cables 1 to 4 to the appropriate customer-furnished uplink signal combiner inputs.
2. Connect the Downlink input cables 1 to 4 to the appropriate customer-furnished downlink splitters.

Note: Be sure to terminate all unused IF outputs and downlink inputs with one of the supplied 75Ω BNC terminations.

3.4.2 System Setup

Enter the SYSTEM SETUP menu to enter, change, or view the system setup configuration. The definitions of the system setup functions are as follows:

Function	Description
TIME AND DATE	Time and date are entered and displayed.
DOWNLINK OPTIONS	Prime and backup downlinks are selected and displayed.
PRIME MODS	Active prime modulators are selected and displayed.
PRIME DEMODS	Active prime demodulators are selected and displayed.
BACKUP MODS	Active backup modulators are selected and displayed.
BACKUP DEMODS	Active backup demodulators are selected and displayed.
MODEM ADDRESSES	Prime and backup modem addresses are selected and displayed.
*PRIME C/U	Active prime channel unit addresses are selected and displayed.
*BACKUP C/U	Active backup channel unit addresses are selected and displayed.

* **Note:** These functions are applicable only for Version 2.02.

In the SYSTEM SETUP menu, view system configuration parameters by using the [NEXT] and [PREV] keys. The user also can enter data or change a parameter through keypad entries.

- When all data or changes for that parameter are entered correctly, press [ENT] to load the information into memory.

- If an incorrect entry is made, press [PREV] to return to that menu and re-enter the data.

3.4.2.1   Time and Date Menu

This menu displays the current time and date. Enter and reset time and/or date as follows:

Time	Press: F1
	Type: HH MM (Use this format)
	Press: ENT (Seconds reset to "0" and the new time loads into the clock device)
Date	Press: F2
	Type: MM DD YY (Use this format)
	Press: ENT (Loads the new date into the clock device)

3.4.2.2   Active Downlink Option Menu

Note: This switch uses only the 4-downlink/2 backup option. There are only four prime modems and backup 2 is ignored.

This menu displays the current downlink and backup options that are active in the system.

1. Press one of the [1] through [9] keys toggles the active status between:

   - 4 downlinks — 2 backups
   - 7 downlinks — 1 backup

2. Press [ENT] to load information into memory.

3.4.2.3   Active Prime Modulators Menu

This menu displays the current prime modulators that are active in the system.

1. Press one of the [1] through [4] keys toggles the active status (ON/OFF) of the corresponding modulator only.
2. Press [ENT] to load information into memory.

3.4.2.4 Active Prime Demodulators Menu

This menu displays the current prime demodulators that are active in the system.

1. Press one of the [1] through [4] keys toggles the active status of the corresponding demodulator only.
2. Press [ENT] to load information into memory.

3.4.2.5 Active Backup Modulators Menu

This menu displays the current backup modulators that are active in the system.

1. Press the [1] key to toggle the active status of the backup modulator only.
2. Press [ENT] to load information into memory.

3.4.2.6 Active Backup Demodulators Menu

Note: The switch does not support the use of a second backup modem. When selecting the active backup for mod, demod, and downlink, the active backup can only be number 1. Selecting backup number 2 to be active will have no effect on the system, except causing backup faults to occur.

This menu displays the current backup demodulators that are active in the system.

1. Press the [1] key to toggle the active status of the backup demodulator only.
2. Press [ENT] to load information into memory.

3.4.2.7 Modem Addresses Menu

This menu displays the current addresses of the prime and backup modems.

Addresses of 1 through 255 are valid.

1. Enter a new address and press [ENT] to load the address into memory.
2. If no address is entered for an active modem, an M:N fault results.

3.4.2.8   Prime Channel Unit Menu

This menu displays the current addresses of active prime channel units (Version 2.02 or greater). Addresses of 1 through 255 are valid.

1. Enter a new address and press [ENT] to load the address into memory.
2. If no address is entered for an active channel unit, an M:N fault results.

3.4.2.9   Backup Channel Unit Menu

This menu displays the current addresses of active backup channel unit (Version 2.02 or greater). Addresses of 1 through 255 are valid.

1. Enter a new address and press [ENT]to load the address into memory.
2. If no address is entered for an active channel unit, an M:N fault results.

Note: To avoid corrupting the configurations of the prime modems, do not use the global address "0".

3.4.3   Modem Setup

To enter, change, or view the modem setup configuration, enter the MODEM SETUP menu. The MODEM SETUP functions are as follows:

Function	Description
DOWNLINK	Downlink assignment (1 through 4) is selected and displayed for demodulators.
MOD PRIORITY	The prime modulator priorities are selected and displayed
DEMOD PRIORITY	The prime demodulator priorities are selected and displayed.
DEMOD DELAY	The prime demodulator online delay is selected and displayed.
MOD DELAY	The prime modulator online delay is selected and displayed.
SELECT C/U	The presence of an external channel unit or buffer is selected and displayed.

1. Press [F1] or [F2] to select prime or backup modems.
2. View the parameters by using the [NEXT] and [PREV] keys.
3. A flashing cursor will be displayed over the selected parameter.

To enter data or change a parameter, the keypad is used to enter the data. When all data or changes for that parameter are correct, press the [ENT] key to load the information into memory.

3.4.3.1 Downlink Selection Menu

Note: Hardware connections for uplink and downlink must be identical to the setup selection. Any difference causes erroneous switch operation.

This menu displays the current downlink number (1 through 4) for each demodulator.

1. Enter the number of the downlink selected.
2. Press [ENT] (that information is loaded into memory).
3. If no downlink is selected for an active demodulator, an M:N fault results.

3.4.3.2 Demodulator Priorities Menus

These menus display the current priority level for all prime demodulators:

- "1" indicates high priority.
- "2" indicates medium priority.
- "3" indicates low priority.

1. Enter priority level and press [ENT] (the information is loaded into memory).
2. If nothing is entered, the priority will be 3 (low priority).

Note: The backup algorithm uses priority levels to make backup decisions. When a backup demodulator is online for a faulted prime with a lower priority than a newly faulted demodulator is, that backup modem becomes available for use to backup the newly faulted unit having the higher priority.

3.4.3.3 Modulator Priorities Menus

These menus display the current priority level for all prime modulators.

- "1" indicates high priority.
- "2" indicates medium priority.
- "3" indicates low priority.

1. Enter priority level and press [ENT] (the information loads into memory).
2. If nothing is entered, the priority will be 3 (low priority).

Note: The backup algorithm uses priority levels to make backup decisions. When a backup modem is online for a faulted prime with a lower priority than a newly faulted modem, that backup modem becomes available for use to backup the newly faulted unit having the higher priority.

3.4.3.4 Demodulator Delay

This menu displays the current demodulator online delay for each prime demodulator, and allows the user to enter a new parameter. The DEMOD DELAY is the time allowed for the prime demodulator to clear its faulted state. At the end of this delay, if the prime is no longer faulted, it will be restored to online status. If the prime is still faulted, the backup demodulator is committed to that channel and will be unavailable for any other faulted prime having the same or lower priority. The user selects "1", "2", or "3":

- "1" = no time delay
- "2" = manual
- "3" = automatic delay selection (2 times the sweep period)

1. Enter DEMOD DELAY # and press [ENT] (loads the information into memory).
2. Enter "2" and press [ENT] (enters a delay from 0 to 127.0 seconds, in 0.5 second increments).
3. Press [ENT] (the delay data loads into memory).
4. If nothing is entered, the switch automatically defaults to "3" (automatic).

3.4.3.5 Modulator Delay

Note: In "modem switch" applications, the MOD/DEMOD DELAY and PRIORITY settings are replaced by MODEM DELAY and PRIORITY settings.

The Modulator Delay menu displays the current modulator online delay for each prime modulator, and allows the user to enter a new parameter. The MOD DELAY is the time allowed for the prime modulator to clear its faulted state. At the end of this delay, if the prime is no longer faulted, it is restored to online status. If the prime is still faulted, the backup modulator is committed to that channel and will be unavailable for any other faulted prime having the same or lower priority. The user selects "1" or "2":

- "1" = no time delay
- "2" = manual

1. Enter MOD DELAY # and press [ENT] (loads the information into memory).
2. Enter "2" and press [ENT] (enters a MOD DELAY from 0 to 127.0 seconds, in 0.5 second increments).
3. Press [ENT], the delay data loads into memory.
4. If nothing is entered, the switch defaults to "1" (None).

3.4.3.6   Channel Unit Selection

Note: The default is Option 1, no channel unit.

This menu displays the current channel unit setting.

- Option 1 selects no channel unit
- Option 2 selects an external channel unit for the modem.

3.4.4   Modem Configuration

3.4.4.1   Prime and Backup Modem Configuration

The prime modems have all parameters properly configured for operation prior to configuration loading or verifying. The only required parameters for a backup modem are the data rate and code rate assignments in the modem's utility menu.

To communicate with the modems, the switch must have the modem addresses entered into the system configuration. The serial interface type, baud rate, and parity of the switch modem control interface are fixed and therefore can not be programmed by the user. For interface information, refer to Section 4.2.

The modems must be set to:

- EIA-485 interface
- 9600 BAUD
- Even parity

Each modem in the switch system must have its own unique address. The interface type, baud rate, parity, and addresses are selected on the M&C card in the modem (see the modem installation and operation manual).

3.4.4.2   Modem Configuration Menu

To load the modem configurations, press [F1] (LOAD) in the MODEM
CONFIGURATION menu and proceed using one of the following steps:

1. Press F1 (SELECT) menu to load the configuration of an individual prime or
    backup modem.

    a. Press [F1] (SELECT), the menu presents options of PRIME (F1) and
        BACKUP (F2).
    b. Select PRIME or BACKUP, the last menu will require entry of the prime
        or backup modem number.
    c. The switch automatically loads the configuration of the modem selected.

2. Press F2 (ALL) menu to load the configuration of all the active modems.

    • Press [F2] (ALL), the menu requires that [ENT] be pressed to begin the
       loading of all active modem configurations.

The switch displays "OK" or "ERROR" showing the result of the configuration loading
process. An "ERROR" response results in an M:N fault.

To verify the modem configurations, Press [F2] (VERIFY) in the MODEM
CONFIGURATION menu and proceed using one of the following steps:

1. Press [F1] (SELECT) menu to verify the configuration of an individual prime or
    backup modem.

    a. Press [F1] (SELECT), the menu presents options of PRIME (F1) and
        BACKUP (F2).
    b. Select PRIME or BACKUP, the last menu will require entry of the prime
        or backup modem number.
    c. The switch automatically verifies the configuration of the modem
        selected.

2. Use the [F2] (ALL) menu to verify the configuration of all the active modems.

    • Press [F2] (ALL), the menu requires that [ENT] be pressed to begin the
       verifying of all active modem configurations.

The switch displays "OK" or "ERROR" showing the result of the configuration loading
process. An "ERROR" response results in an M:N fault.

Note: When any change is made in the prime or backup modem configuration, reload
that modem's configuration in the switch. If this is not performed, a configuration verify
error will be flagged in the M:N fault menu.

3.4.5   Operation Modes

The MODE menu selects the mode of operation. At power-up, the switch defaults to the BYPASS mode unless both of the following conditions exist:

- It was in a different mode prior to loss of power.
- Battery-backed memory was maintained.

The following modes of operation are available:

BYPASS	All switching is halted. No change will take place until the switch is returned to the AUTO, LOCAL, or REMOTE mode.
AUTOMATIC	The Monitor and Control controls all switching.
LOCAL	The on-site user controls all switching.
REMOTE	In the REMOTE mode, a remote controller via the remote interface controls all switching. The on-site user cannot select this mode of operation.

3.4.5.1   Bypass Mode

The BYPASS mode is recommended for initial and subsequent configuration functions. It is the default-operating mode at power-up if the switch was not programmed for a different mode prior to loss of power or if the battery-backed memory was not maintained. The switch is not capable of performing any switching functions in the BYPASS mode. All configuration and communication functions continue to operate, but no new backup operation can take place. Any backup operation performed prior to selecting BYPASS will remain in effect.

To enter the BYPASS mode, proceed as follows:

- Press [3] and [ENT] while in the MODE menu.

3.4.5.2   Auto Mode

The AUTO mode is the normal operating mode for the switch. Refer to the flowcharts in Figure 3-3 and Figure 3-4. If the switch was in this mode when power loss occurred, it will return to this mode when power is restored (all previous backup status will be lost). If there are faults present when power is restored, the switch will backup the highest priority faulted modulator and/or demodulator accordingly. Because the switch is communicating with the prime and backup modems in this mode, response to keypad input and remote communication may be delayed.

To enter the AUTO mode, proceed as follows:

- Press [1] and [ENT] while in the MODE menu.

In the AUTO mode, the switch monitors the prime and backup modulator and demodulator fault inputs, awaiting a failure.

- When no faults are present, the switch will place the backup modulator and demodulator in the "Hot Standby" mode and a dash (–) will be displayed in the status display. In this mode, the switch programs the backup modulator and demodulator for the highest priority lowest numbered prime modulator and demodulator, and connects the downlink IF to the backup demodulator. This action prepares the backup modulator and demodulator for a minimal delay backup of high-priority channels.

- When a fault does occur, the switch takes action according to the backup algorithm. The backup algorithm selects the highest priority, lowest numbered faulted channel for backup and will take a lower priority channel backup offline, even if that channel is faulted, to back up a higher priority channel.

When a demodulator backup is required, the switch performs the following steps:

1. It verifies the configuration of the backup demodulator and reprograms it, if necessary.

2. If more than one demodulator is faulted, the switch selects the demodulator with the highest priority. If more than one faulted demodulator is set to the highest priority, the switch selects from those the demodulator with the lowest channel number.

3. The switch implements the sweep delay (not programmable by the user). This delay is two times the sweep period of the demodulator. At the end of the sweep delay or when the backup demodulator locks, the switch performs one of the following operations:

    a. If the backup demodulator fails to lock, the switch makes the backup demodulator available for other faulted channels.

    b. If the backup demodulator locks, the switch commits the backup demodulator to the faulted prime and starts the demodulator delay timer. An asterisk (*) will be displayed in the status display.

4. At the end of the demodulator delay, the switch again checks the fault status of the prime demodulator.

    a. If the prime demodulator is still faulted, the switch places the backup demodulator online for the faulted prime, and an arrow (→) will be displayed in the status display. The backup will then be available only to failed primes having higher priority.

    b. If the prime demodulator has locked during the demodulator delay, the backup demodulator is made available for other faulted primes.

When a modulator backup is required, the switch performs the following steps:

1. It verifies the configuration of the backup modulator and reprograms it if necessary.

2. If more than one modulator is faulted, the switch selects the modulator with the highest priority. If more than one faulted modulator is set to the highest priority, the switch selects the modulator with the lowest channel number.

3. It implements a 500-millisecond delay (not programmable by the user). At the end of the delay, the switch performs one of the following operations:

   a. If the prime modulator is not faulted, the switch makes the backup modulator available for other faulted channels.

   b. If the backup modulator is not faulted and the prime remains faulted, the switch commits the backup modulator to the faulted prime and starts the modulator delay timer. An asterisk (*) is displayed in the status display.

4. At the end of the modulator delay, the switch again checks the fault status of the prime modulator.

   a. If the prime modulator is still faulted, the switch places the backup modulator online for the faulted prime, and an arrow ($\rightarrow$) is displayed in the status display. The backup is then available only to failed primes having higher priority.

   b. If the prime modulator clears its fault during the modulator delay, the prime modulator is restored to service. The backup modulator is made available for other faulted primes.

When a modem backup is required, the switch performs both demodulator and modulator procedures simultaneously. However, the switch will not place the backup modem online until the backup demodulator locks and the modem online delay timer times-out.

The switch continually verifies the configurations of all-active modulators and demodulators. If the switch fails to verify any configuration, an M:N fault results.

Changing from any mode to another mode (including AUTO) does not change the backup status unless a new fault occurs.

3.4.5.3   Local Mode

In this operating mode, the switch responds to keypad input affecting setup, configuration, fault inquiries, and backup online status.

If the switch is in this mode when power loss occurs, it will return to this mode when power is restored. However, the current backup status will be lost.

This mode also can be used for initial and subsequent configuration functions. (To enter the LOCAL mode, press [2] and [ENT] while in the MODE menu.)

To change the backup status from local mode:

1. Press [F1] or [F2] to select modulator or demodulator. (If the switch is a modem switch rather than an independent modulator/demodulator switch, press [ENT] to continue.)
2. Select the backup modem number (1 or 2) and press [ENT].
3. Select the prime modem number from 0 to 4. ("0" takes the backup modulator or demodulator offline; "1" to "4" selects that prime for backup.)
4. Press [ENT].

The switch performs the selected backup function and displays the online and fault status. When the switch is in LOCAL mode, exercise care when changing the online status, as the switch performs the selected function regardless of fault status or modulator and demodulator compatibility.

3.4.5.4   Remote Mode

In this operating mode, the switch responds to serial remote interface or relay-remote input. The switch can receive a full range of commands from the serial remote interface user and a limited number from the relay-remote interface. If the switch was in this mode prior to loss of power, it returns to this mode when power is restored. However, current backup status will be lost. This mode can be entered only from the serial remote interface or relay-remote interface.

For details of the remote interface specification, refer to Section 4.1.4 and Appendix A.

3.4.6   Faults

When any fault LED(s) is lighted, an operational fault condition exists. However, the LEDs are only a summary visual alarm. The user uses the FAULT menu to determine the exact cause of the fault and takes remedial action if necessary.

The FAULT menu provides fault information. Use the 1, 2, 3, 4, [NEXT], and [PREV] keys to reveal the nature of any fault indicated by a front panel red LED.

The following sections list all the possible fault messages that could appear in each category. Refer to Section 5.2 for a list of the possible causes and for the fault isolation procedures.
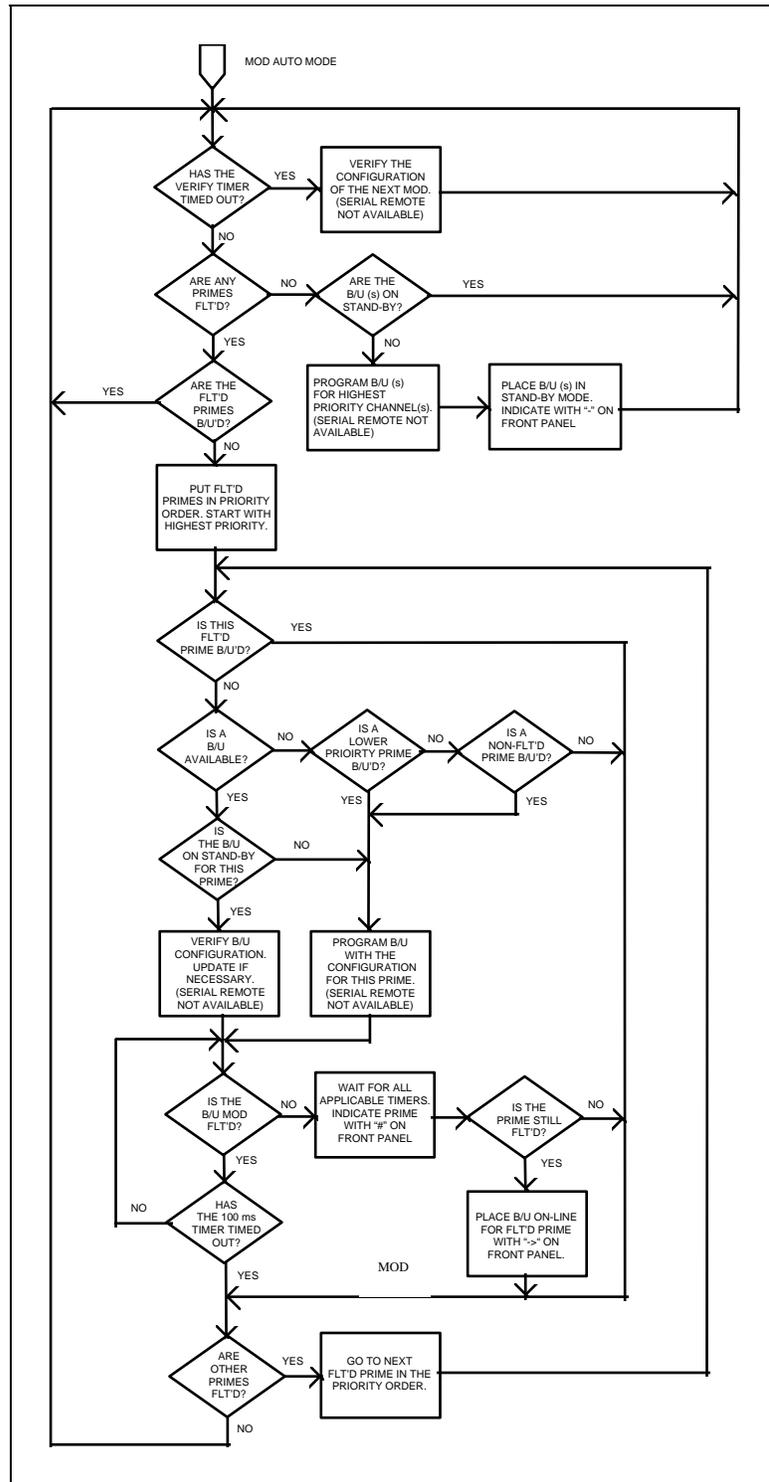
Figure 3-3. SMS-458B Switching Algorithm Flow Chart Demodulator
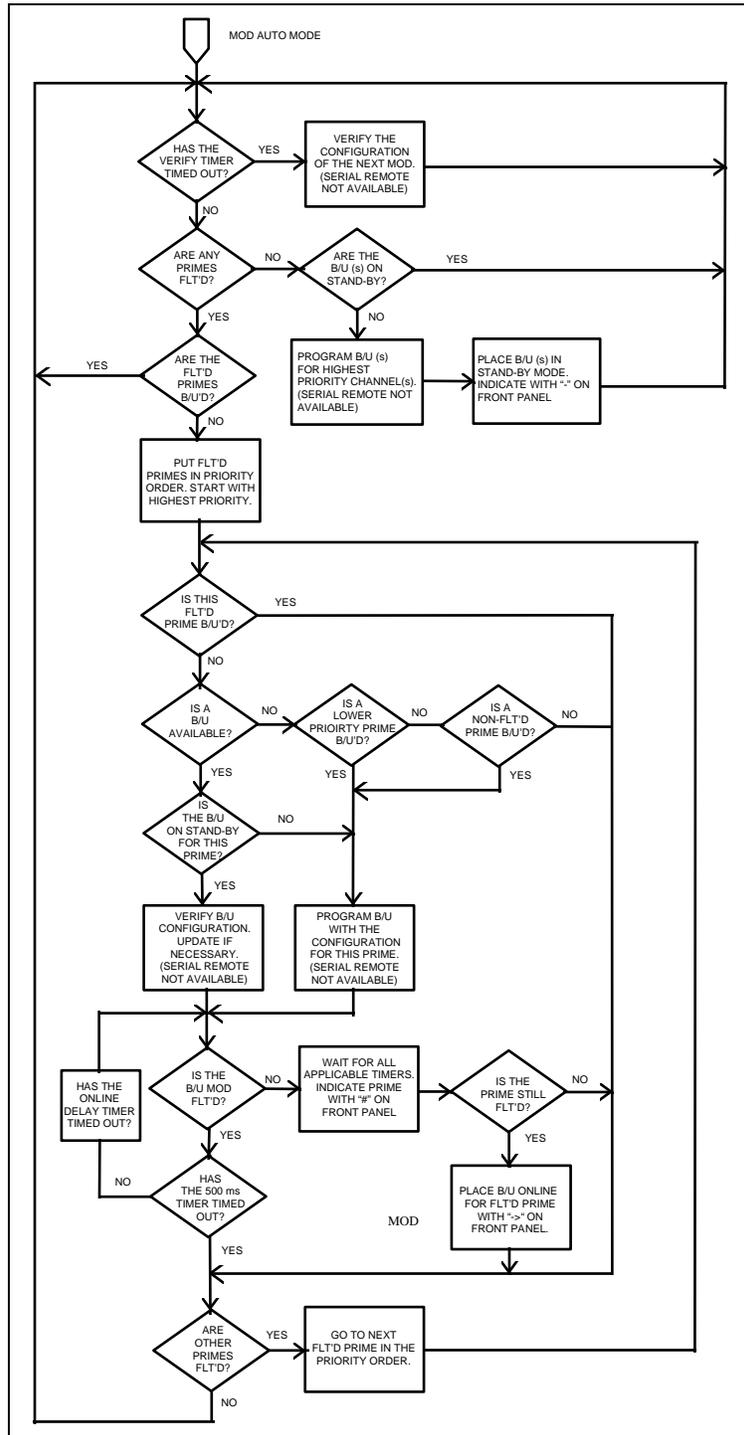
Figure 3-4. SMS-458B Switching Algorithm Flow Chart Modulator

3.4.6.1   Modulator Operation Fault

The fault menu displays MOD fault(s) when a modulator backup switching operation
failure occurs. The messages will be as follows:

BK-UP FAULT MOD X	(where X = 1 to 4)

3.4.6.2   Demodulator Operation Fault

The fault menu displays DEMOD fault(s) when a demodulator backup switching
operation failure occurs. The messages will be any of the following:

BK-UP FAULT DMD X	(where X = 1 to 4)
ALL DMDS D/L X FAULTED.	(where X = 1 to 4)

3.4.6.3   M:N Faults

The fault menu displays M:N fault(s) when a communication, configuration, setup,
and/or power supply failure occurs. The messages will be any of the following:

```
MODEM X COMM FAILURE
MODEM B1 COMM FAILURE
CONFIG VERIFY ERROR M (or D) X
CONFIG VERIFY ERROR BM (or BD) 1
BK-UP M (or D) 1 NOT COMPATIBLE
PRIME M (or D) X NOT COMPATIBLE
NO ADDRESS FOR PRIME X
*NO ADDRESS FOR C/U X
NO ADDRESS FOR BK-UP 1
*NO ADDRESS FOR C/U B 1
NO INTERFACE FOR PRIME X
NO INTERFACE FOR BK-UP 1
NO D/L FOR DMD X
NO CONFIG FOR PRIME M (or D) X
NO CONFIG FOR BK-UP M (or D) 1
+12V FAILURE
-12V FAILURE
+5V FAILURE
POWER SUPPLY 1 FAULT
POWER SUPPLY 2 FAULT

Where X = 1 through 4
```

Note: These faults appear only if an external channel unit is selected.

3.4.6.4 Battery Faults

The fault menu displays BATTERY fault when a battery failure occurs in the switch. The message will be as follows:

```
M & C BATTERY FAULT
```

3.4.7 Front Panel Theory of Operation

The Front Panel Control module contains:

- 48-character, dual row LCD display
- 16-key keypad
- 9 LEDs
- Audible buzzer
- Peripheral logic to interface with the M&C module

The display, LEDs, and buzzer are mapped into address space of the external bus structure. The display updates every second, and the LEDs and buzzer update as needed.

Any keypad activity provides an interrupt to the processor, which then scans the keypad. After the input has been recognized, the processor takes the appropriate action.

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Chapter 4. THEORY OF OPERATION

This chapter describes switch theory of operation.

4.1   Monitor and Control

4.1.1   General

A sophisticated microcontroller performs the monitor and control functions of the switch. The module, called the Monitor and Control (M&C), plugs into slot 5 of the switch chassis, and is shown in Figure 4-1.

The M&C monitors the switch configuration and updates other modules within the switch as required. Switch configuration parameters are stored in battery-backed RAM to provide total recovery after a power-down. The switch gathers status and provides extensive fault monitoring. A local front panel interface and a remote communications interface provide user access to all switch functions.
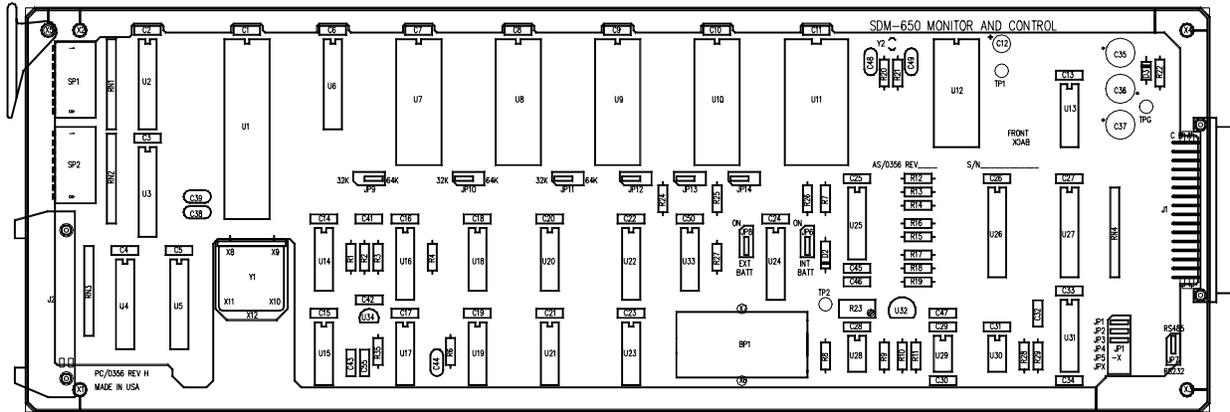
Figure 4-1. Monitor and Control

4.1.2 Description of Options

4.1.2.1 M&C Serial Interface

The M&C communicates with the address decoder/driver through an EIA-232 interface.

Set the M&C for EIA-232 operation as follows:

1. Remove JP1, JP2, and JP3.
2. Install JP4, JP5, and JPX.
3. Install JP7 at EIA-232 location.

4.1.2.2   Remote Baud Rate

The 8-position switch pack SP1 on the M&C module programs the external remote serial communications baud rate and parity. Set the switches to ON (nearer the PCB) or OFF (away from the PCB) to select parity and baud rate.

SP1 switch position 1 (SP1-1) sets the parity:

- OFF = even parity
- ON = odd parity

SP1 switch positions 2, 3, and 4 (SP1-2, SP1-3, and SP1-4) set the baud rate as follows:

Baud	SP1-2	SP1-3	SP1-4
110	ON	ON	ON
150	ON	ON	OFF
300	ON	OFF	ON
600	ON	OFF	OFF
1200	OFF	ON	ON
2400	OFF	ON	OFF
4800	OFF	OFF	ON
9600	OFF	OFF	OFF

4.1.2.3   Remote Address

The switch connects to an EIA-485 remote communication link. To communicate on this link, each switch and modem must have a unique address between 1 and 255.

Note: "0" cannot be a device address, as it is the global address for all devices.

To program an address, use the 8-position switch pack, SP2, on the M&C module. Addresses are binary coded numbers:

- Switch position 1 (SP2-1) is the most significant bit.
- Switch position 8 (SP2-8) is the least significant bit.

To turn ON any switch, move it to the position closer to the PCB. See the following examples.

Address	SP2-1	SP2-2	SP2-3	SP2-4	SP2-5	SP2-6	SP2-7	SP2-8
1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON
3	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
5	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON
9	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON
17	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
33	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
65	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
129	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON
255	ON	ON	ON	ON	ON	ON	ON	ON

4.1.2.4 External Remote Serial Interface Selection

An EIA-485 or EIA-232 communications link on the address decoder/driver module provides remote serial interface for all switch functions.

The EIA-485 interface allows up to 32 devices to operate on a common communication link. Each device must have a discrete address (there are 255 discrete addresses). EIA-232 communication is only possible with a single device. During configuration setup, the switch is configured for EIA-232 communication, whether EIA-232 or EIA-485 communication is desired. See Figure 4-1 for location of the switches.

Use M&C module switch pack SP1 switch 5 (SP1-5) to configure each switch for external remote interface type, either EIA-485 or EIA-232. The ON position (nearer the PCB) selects EIA-232 interface and OFF selects EIA-485.

4.1.2.5 Battery

A rechargeable battery on the M&C module allows it to retain configuration and status information for up to 30 days without prime power. M&C module jumper JP6 connects battery power to the backup RAM. During normal operation, this jumper should be in the ON position.

Should the switch be powered-down, the M&C microcontroller performs the following sequence:

1. Upon power-up, the M&C microcontroller checks the battery-backed RAM for valid data. If valid data has been retained, the M&C implements the RAM-stored switch configuration.

2. If the battery-backed RAM fails the valid data test, the switch loads default settings from ROM.

Note: JP8 external battery jumper is not supported in the switch chassis, and therefore must be set to the OFF position.

4.1.2.6   Error Response Switch

The Error Response function is an error message function that indicates that the command sent cannot be carried out because local processing is utilizing the modem control bus, local keyboard control, etc.

SP1 position 6 is the error response switch. The "ON" position enables the error response function, and the "OFF" position disables the error response function.

4.1.2.7   External I/O Interrupt Arbitration

The switch does not use the external I/O interrupt arbitration function.

Note: JP12, JP13, and JP14 must be in the "LEFT" position to disable this function.

4.1.3   Modem Control Interface Specification

The modem control interface is an EIA-485 serial communication link, which allows the switch to maintain control of backup modems and verify the configuration of the prime and backup modems.

The EIA-485 interface permits up to 32 devices to operate on a common communication link, however, only modems and channel units may be connected to this communication link. External remote communication to the modems and switch is done through the external remote interface.

The user cannot configure the parameters of the EIA-485 interface. The baud is fixed at 9600 and parity is even. All devices communicating with the switch must have their remote control interface configured to those parameters. Each modem and channel unit must have a unique address.

For details of remote interface specification and configuration for each device, refer to the respective Installation and Operation Manual.

4.1.4   Relay-Remote Interface Specification

4.1.4.1   Scope

This section defines the protocol and the word and command structure of the relay-remote interface.

4.1.4.2   General

The relay-remote input (J6) allows the user to execute a limited number of mode and online commands (refer to Section 2.2.5 for connector location and pinout).

These commands are a series of 4-bit words. The switch has a 4-line parallel interface with pull-up resistors (10 KΩ to +5V). Thus, open inputs are logic high, and connecting to pin 25 of J6 can generate logic low inputs. The inputs can also be driven directly from TTL or CMOS family devices.

The M:N switch recognizes a word 100 msec after the change of state is detected on the parallel interface. The words must be held for 200 msec, and should not be sent faster than 500 msec or slower than 10-second intervals. The word can be repeated any number of times, but the switch only detects it the first time it is sent. The following section describes the commands that can be executed.

4.1.4.3   Command Structure

A command to the switch consists of three or four words sent on the four parallel lines in one of the following formats:

- Non-return-to-zero (NRZ)
- Return-to-zero (RZ)

The command sequence begins with the START word. The switch recognizes each word by changes of state at the relay-remote inputs. After debounce, the switch identifies the word. If all words are valid and the EXECUTE word is received, the switch performs the command.

The command words START and EXECUTE are defined in Table 4-1.

Table 4-1. Relay-Remote Command Words

	Input Lines			
Command Word	**Rem3**	**Rem2**	**Rem1**	**Rem0**
AUTO	N	N	C	N
REMOTE	N	N	N	C
B/U MOD 1	C	C	N	C
B/U DEMOD 1	C	N	N	C
START	C	C	C	C
EXECUTE	C	C	N	N

Notes:
1. C = Change of state.
2. N = No change of state.

Target words are defined in Table 4-2.

Table 4-2. Modem Target Words

Target Modem	Input Lines			
	Rem3	Rem2	Rem1	Rem0
1	N	N	N	C
2	N	N	C	N
3	N	N	C	C
4	N	C	N	N

Notes:
1. C = Change of state.
2. N = No change of state.

Table 4-3 describes the six command functions that can be executed.

Table 4-3. Relay-Remote Command Functions

Function	Description
AUTO	Executed only from REMOTE mode. This function places the switch in the automatic mode of operation.
REMOTE	Executed from any operating mode other than REMOTE; must be executed before any other relay-remote function. This function places the switch in the remote mode of operation.
BACKUP MOD 1	Executed only from REMOTE mode. This function is used to place backup modulator 1 online when it precedes a target word or offline when it precedes EXECUTE.
BACKUP DEMOD 1	Executed only from REMOTE mode. This function is used to place backup demodulator 1 online when it precedes a target word or offline when it precedes EXECUTE.

A valid command structure consists of words in the following order:

1. The START word begins all messages.

2. The COMMAND word follows the start word.

3. If the command affects the online or offline status of a prime modulator or demodulator, the next 4-bit word must be the TARGET word. The format for the target word is the BCD number for the prime modulator or demodulator. The target word is not sent if the backup is to be taken offline or AUTO or REMOTE mode is selected.

4. The EXECUTE word follows the target (or command) word.

The command words must be sent to the switch with no more than 10 seconds between words for the switch to recognize a command. If the interval exceeds 10 seconds, the M&C resets the word buffer and waits for the next START word.

If an incorrect word is sent, begin the message sequence again with the START word. This word restarts the message sequence.

Table 4-4 shows some relay-remote command examples.

Table 4-4. Relay-Remote Command Examples

Command Words	Input Lines				Comments
	Rem3	Rem2	Rem1	Rem0	
START	C	C	C	C	Places the M:N in the
REMOTE	N	N	N	C	the remote mode.
EXECUTE	C	C	N	N	
START	C	C	C	C	Places B/U mod 1
B/U MOD 1	C	C	N	C	online for prime 2.
TARGET PRIME 2	N	N	C	N	
EXECUTE	C	C	N	N	
START	C	C	C	C	Places B/U demod 1
B/U DEMOD 1	C	N	N	C	online for prime 4.
TARGET PRIME 4	N	C	N	C	
EXECUTE	C	C	N	N	
START	C	C	C	C	Places the M:N in the
AUTO	N	N	C	N	auto mode.
EXECUTE	C	C	N	N	

Notes:
1.   C = Change of state.
2.   N = No change of state.
3.   Mod = Modulator.
4.   Demod = Demodulator.

4.1.5   **Fault Interface Specification**

Note: These contacts report summary status. To determine the exact fault, the user must make further inquiry, as described in Section 3.4.6.

This section defines the protocol and format structure for monitoring the fault status interface of the switch.

The relay-remote/fault rear panel connector (J6) provides interface for fault status information. (See Section 2.2.5 for connector location and pinout information.)

Three non-latching relays with form-C contacts show:

- Controller status
- M:N status
- Demodulator signal status

4.1.5.1 Controller Fault

A controller fault is a catastrophic failure that renders the switch nonfunctional. A timer on the M&C periodically sets a monostable, which controls the fault relay.

The controller fault relay NC and COM contacts close when:

- No power is applied to the switch.
- When the M&C fails to set the monostable.

During normal operation (when no fault occurs), the relay NC and COM contacts are open and the NO and COM contacts are closed.

4.1.5.2 M:N Fault

An M:N fault is any failure of backup operation, communication, configuration, and/or setup that may (or may not) render the switch nonfunctional.

During normal operation or power-off, the relay is de-energized (COM to NC). When any failure occurs, the relay energizes (COM to NO). It remains energized until the failure is eliminated.

4.1.5.3 Demodulator Signal Fault

A demodulator signal fault is the failure of all active demodulators on the indicated downlink to acquire and lock to their signals. The fault alarm indicates a possible down converter system failure causing loss of IF to the demodulators. During normal operation or power-down, the relay is de-energized (COM to NC).

When all demodulators indicate loss of carrier, the relay energizes (COM to NO). The relay remains energized until the failure is eliminated.

4.1.6 Online Status Specification

This section defines the protocol and format for reporting the online status of the switch.

The M&C commands the online telemetry module to report online status for all active prime modulators and demodulators. The status is reported as form-C relay contact to the online status connectors (J4 and J5) on the rear panel (see Section 2.2.4 for connector locations and pinouts).

The active modulators online status is indicated at J4 by form-C relay contacts. When the prime is online or power is off, the relay is de-energized (COM to NC). When a backup modulator goes online for that prime, the relay energizes (COM to NO).

The active demodulators online status is indicated at J5 by form-C relay contacts. When the prime is online or power is off, the relay is de-energized (COM to NC). When a backup demodulator is online for that prime, the relay is energized (COM to NO).

4.1.7 Monitor and Control Theory of Operation

The Monitor and Control module uses an Intel 80C31 microcontroller operating at 5.5295 MHz. The microsystem supports 128K bytes of Read Only Memory (ROM) for code and 64K bytes of Random Access Memory (RAM) for data.

Of the 64K bytes, only 8K is used for RAM, the remaining 56K is used for memory-mapped I/O.

Memory-mapped I/O includes:

- Real time clock/memory
- 8-channel analog-to-digital converter
- External buffered bus structure for overall switch control and status gathering

The 80C31 microcontroller supports a serial asynchronous communications channel (EIA-232C) with a maximum baud rate of 9600 bit/s using the 5.5295 MHz reference.

A rechargeable battery maintains the system real time clock and switch configuration through power-down situations.

Memory is maintained up to 30 days without power.

A full battery charge is attained after the modem is powered on for 48 hours.

4.2 Interface Switches

4.2.1 IDR/G.703 Interface Switch

4.2.1.1 General Description

The IDR/G.703 interface switch module switches all interface signals by relay. The prime interface switch module (Figure 4-2) has two 50-pin female D connectors and four BNC connectors. The terrestrial interface J1, J2, and J5 (top) is a DCE interface, and the prime modem interface J3, J4, and J6 (bottom) is a DTE interface. The prime interface switch module can plug into any of the even-numbered interface switch module slots (A2, A4, A6, and A8) on the left side of the lower-rear panel.

The backup interface switch module (Figure 4-3) has one 50-pin female D connector and two BNC connectors. The backup modem interface connectors J1 and J2 carry the G.703

data, and J3 is the IDR with ESC interface. The backup interface switch module can plug into A10 slot only.

When the interface switch module is powered down or in the default position, all prime interface switch module signals are routed between the terminal equipment and the prime modem.

Modulator and/or demodulator signals can be independently switched to the backup modem interface switch module. The fault lines from the modem connector are routed through the interface switch modules to the M&C.

When using G.703 data switching, a buffered set of transmit data (SD) signals is switched to the "hot standby" backup modulator and demodulator during prime modem operation, or to the offline prime modulator and demodulator when a backup operation occurs.

4.2.1.2 Specification (IDR/G.703)

Circuits Supported	SD, RD, EXC, TXD, TXC, TXO, RXD, RXC, RXO, BWO 1-4, BWI 1-4, A1I, A1O, A2I, A2O, DEMOD FAULT.
Switching Format	All signals switched with dry contacts.
Contact Arrangement	Modulator signals: 16 poles. Demodulator signals: 26 poles. Spares: 2 poles. Demodulator signals: 26 poles. Spares: 2 poles.
Synthesized Data Source	All ones Data Pattern.

4.2.1.3   Connector Pinout

The IDR interface uses a 50-pin female D connector. Screw locks and latching blocks provide mechanical security of the mating connector.

Signal Function	Name	Pin #
Ground	GND	1, 2
8 kbit/s TX Data	TXD-A	37
	TXD-B	38
8 kHz TX Clock Out	TXC-A	21
	TXC-B	22
1 kHz TX Octet In	TXO-A	4
	TXO-B	5
8 kbit/s RX Data	RXD-A	39
	RXD-B	40
8 kHz RX Clock Out	RXC-A	23
	RXC-B	24
1 kHz RX Octet Out	RXO-A	6
	RXO-B	7
Backward Alarm 1 Out	BWO1-C	8
	BWO1-NC	25
	BWO1-NO	41
Backward Alarm 2 Out	BWO2-C	9
	BWO2-NC	26
	BWO2-NO	42
Backward Alarm 3 Out	BWO3-C	10
	BWO3-NC	27
	BWO3-NO	43
Backward Alarm 4 Out	BWO4-C	11
	BWO4-NC	28
	BWO4-NO	44
Backward Alarm 1 In	BWI1	12
Backward Alarm 2 In	BWI2	13
Backward Alarm 3 In	BWI3	14
Backward Alarm 4 In	BWI4	15
ADPCM 1 Audio In	A1I-A	45
	A1I-B	29
ADPCM 1 Audio Out	A1O-A	46
	A1O-B	30
ADPCM 2 Audio In	A2I-A	47
	A2I-B	31
ADPCM 2 Audio Out	A2O-A	48
	A2O-B	32
Demod Fault Relay	DF-C	16
	DF-NO	50
Modulator Fault	MF	49
Demodulator Fault	DF	33
Deferred Maintenance Alarm	DMA	17

Note: MF and DF inputs are located only on the prime and backup modem interface connectors, not the terrestrial data connectors.
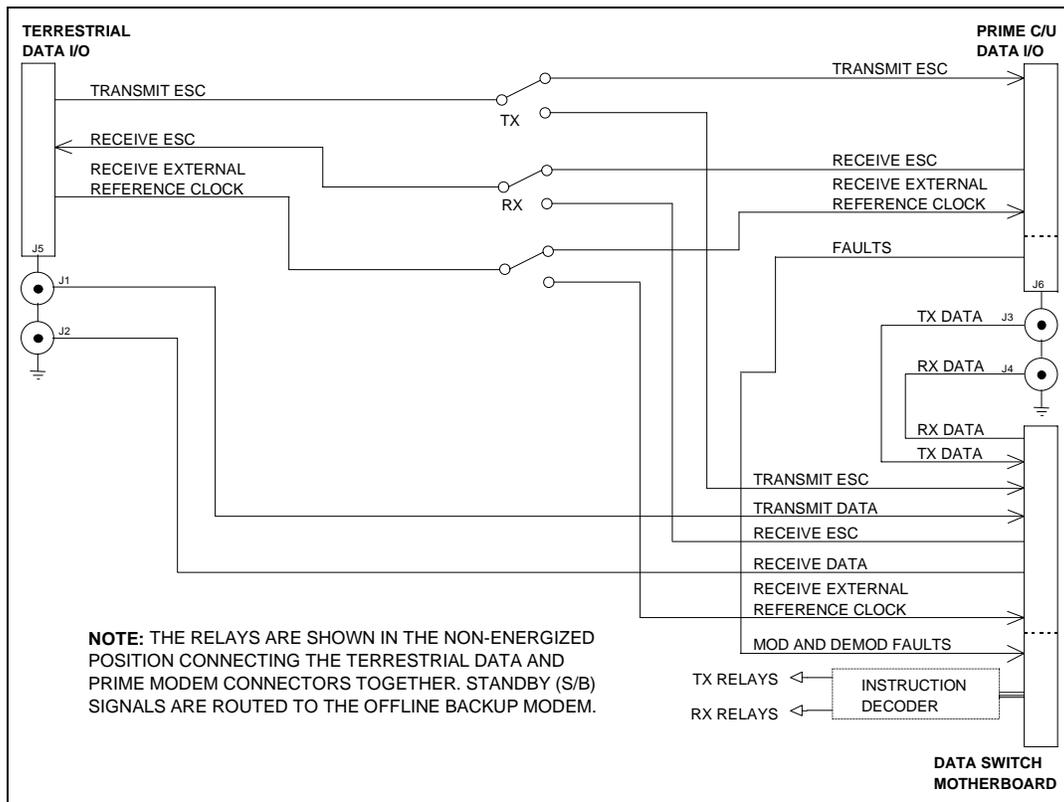
Figure 4-2. Prime IDR/G.703 Interface Switch
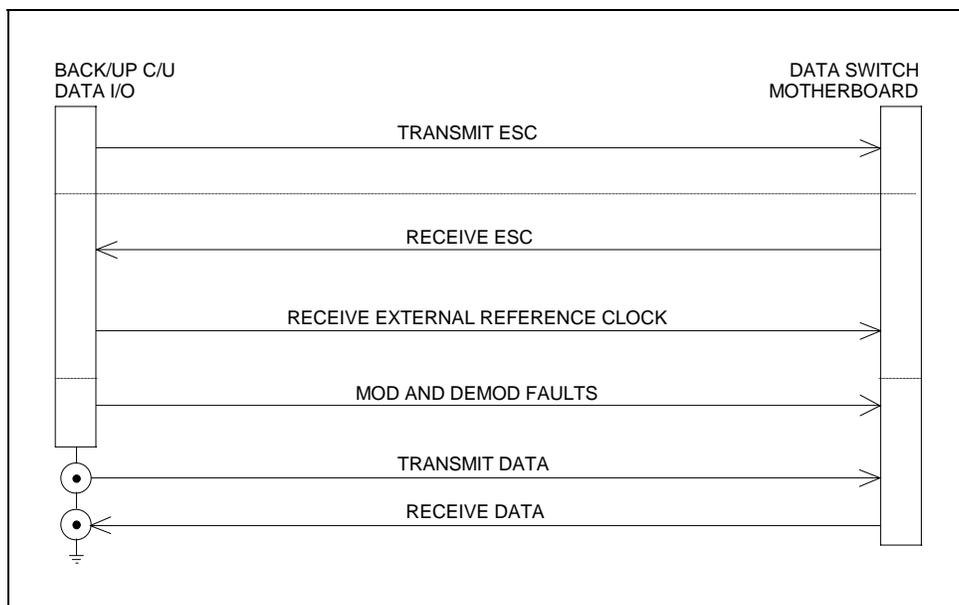
Figure 4-3. Backup IDR/G.703 Interface Switch

4.3　　　Address Decoder/Driver

4.3.1　　　General

The address decoder/driver is a 10.5 x 3.5 inches module (Figure 4-4) that fits into slot 4 of the front-upper section of the switch chassis. Its functions include:

- Address decoding of the external address bus
- External data bus buffering
- Serial communications interface
- Modem fault interface
- Fault outputs

Refer to Figure 4-5 for a block diagram of the address decoder/driver card.
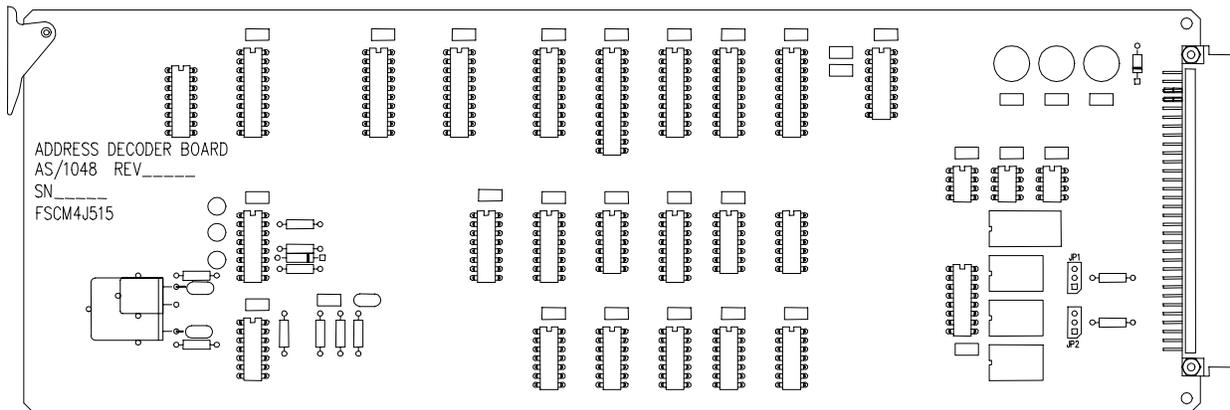
Figure 4-4. Address Decoder/Driver
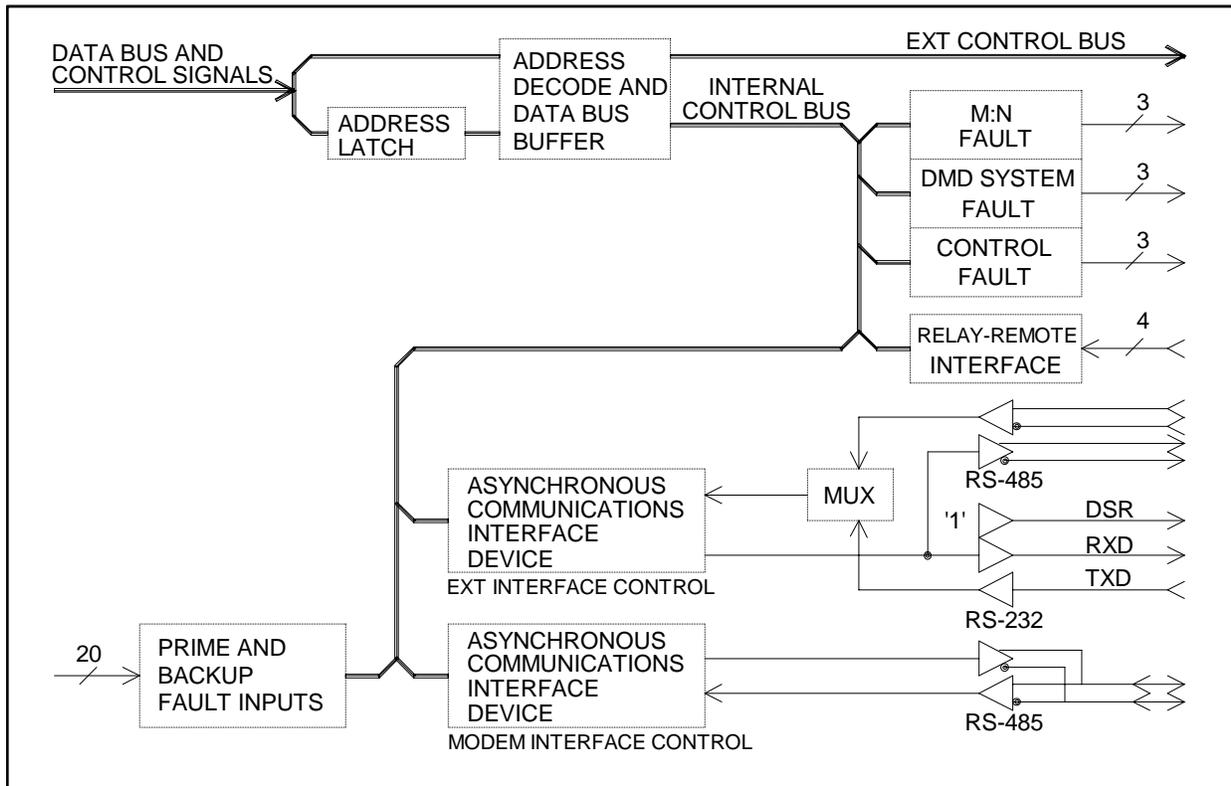
Figure 4-5. Address Decoder/Driver

4.3.2 Specifications

Address Decoding	2K bytes of address bus decoded to 24 discrete channels.
Data Bus Buffering	8 bits to all peripheral devices.
Communication Interface: Remote interface	EIA-485 or EIA-232, 255 addresses, 110 to 9600 baud.
Relay-remote interface	4 lines (parallel).
Modem Control Interface	EIA-485, 255 addresses, 9600 baud. (Dual ACIAs on the AS/1048 board enable simultaneous communication on both Remote and Modem control interfaces.)
Modem Fault Interface	10 lines for Muxed modulator and demodulator faults.
Fault Outputs	Controller Fault: Form-C. System Fault: Form-C. Demod Signal Fault: Form-C.

4.3.3   Address Decoder/Driver Theory of Operation

The address decoder/driver interfaces the:

- M&C data bus
- Address bus
- Control lines
- Serial interface

Addresses of the peripheral devices, both on and off of this card, are latched and decoded to select each device. The data bus is bidirectionally buffered to and from the M&C card. The data bus and decoded address lines are buffered off this card as they are output to the other modules.

The address decoder/driver formats the serial data communication to and from the M&C. All interface drivers and receivers for external communication are on this module.

The fault lines from the interface switch modules are routed to this card. The M&C reads the faults at regular intervals to update its own registers.

The address decoder/driver card contains the following fault relays:

- M:N summary
- Demodulator signal
- Controller

The M&C control the M:N summary and demodulator signal fault relays directly.

A "watchdog" timer controls the controller fault. The M&C must reset the "watchdog" timer at regular intervals, or the controller fault will set.

4.4   IF Switch Driver

The IF switch driver (Figure 4-6) is a 10.5 x 3.5 inches module that fits into slot 3 of the upper-front section of the switch chassis. It controls activation of the baseball switches on the IF Switch card.

Both +5V and +12V are utilized on this card.

The M&C uses the address decoder/driver with an 8-bit data bus and one device select line to control the switch driver. The switch driver decodes commands from the M&C card and activates the appropriate baseball switches on the IF switch in accordance with these commands.

Refer to Figure 4-7 for a block diagram of the IF Switch Driver card.
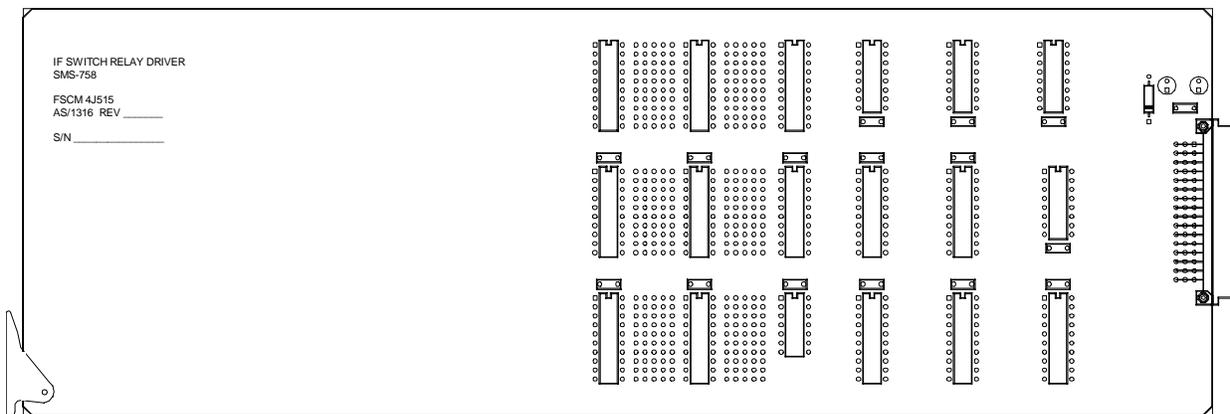
Figure 4-6. Switch Driver
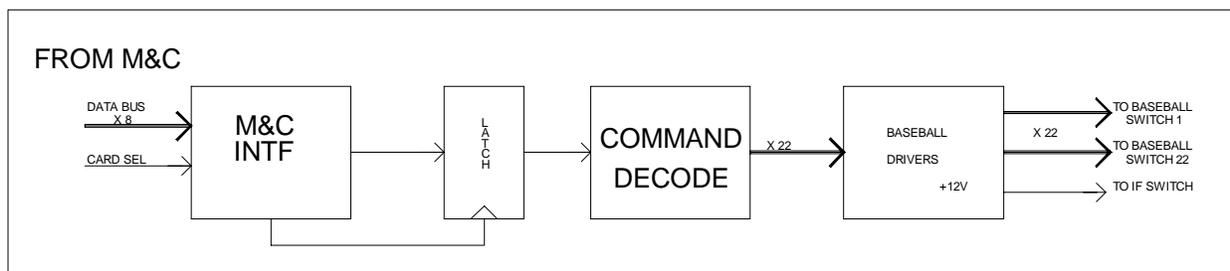
Figure 4-7. IF Switch Driver Block Diagram

4.5   Data Switch Controller Card

The data switch controller (Figure 4-8) resides in the data switch (lower) section in the switch. The card performs two main functions:

- The card decodes M&C commands in order to control the data switching matrix.

- The card contains a synthesized data source, which is used to keep a data stream to the offline modulator. This is done so the offline modulator does not show a faulted condition due to loss of data.

Since the data that is fed to the offline modulator as an all 1s pattern, the modem will show AIS indication. The data rate is programmed automatically when the user programs the switch. The on-board oscillator has a fine tune adjustment, R29 (which is set at the factory), for the oscillator frequency, and can be monitored by connecting a frequency counter to J3.

The data rate of the oscillator frequency can be programmed from 32 to 45 Mbit/s.
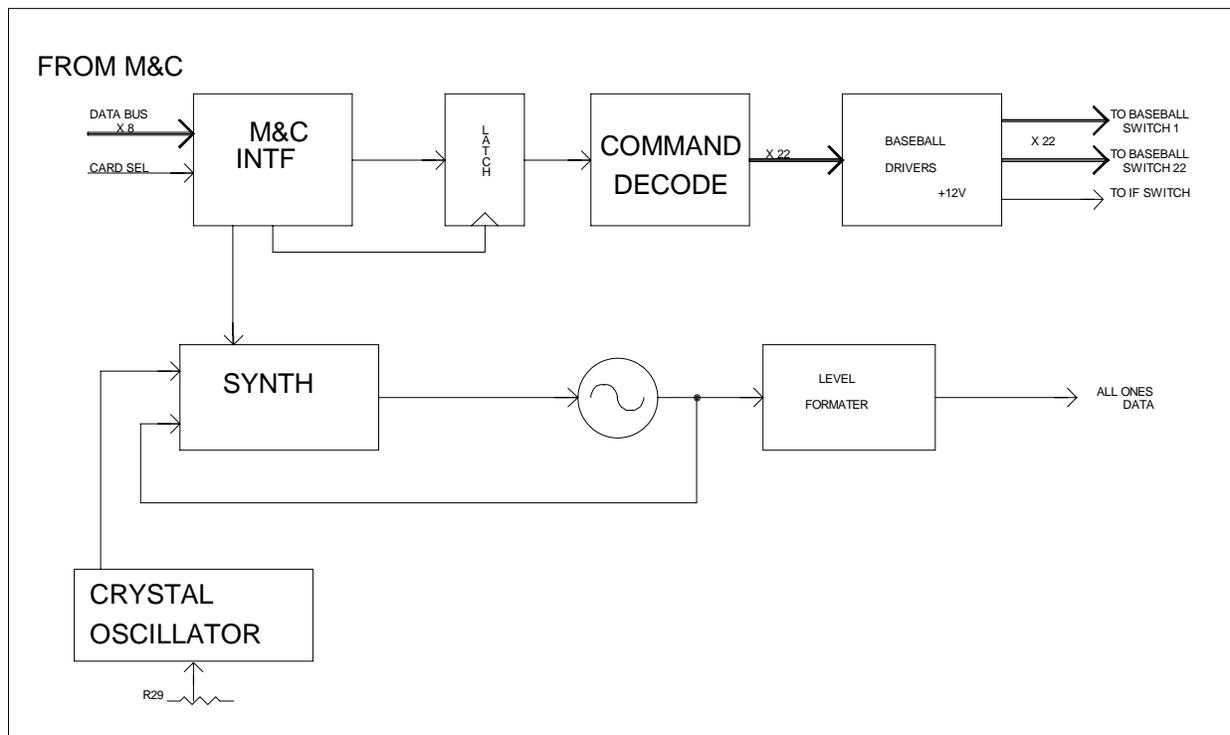
Figure 4-8. Data Switch Controller Card

4.6 IF Switch

4.6.1 General

The IF switch (Figure 4-9) is a 14.0 x 5.0 inches module that fits in the lower section of the switch chassis. It isolates the backup modulator's IF outputs and connects the backup modulator's output in place of any of the prime modulators when a fault is detected. It also connects the IF backup demodulators inputs to one of four downlink inputs.

There are two IF switch cards in the switch:

- One for transmit switching.
- One for receive switching.

4.6.2 Specifications

Power source	+12V
Isolation	≥ 60 dB
Balance	± 0.25 dB
Loss	≤ 1 dB

4.6.3 IF Switch Theory of Operation

The IF switch contains 22 baseball switches that comprise the IF switching matrix. Each baseball switch is controlled separately by the M&C card via the switch driver card.

The modulator section of the switching matrix contains 16 of the switches that control the backup modulator outputs to switch to any of the eight prime modulator outputs if a fault is detected by the M&C card. The operator can also manually select a backup modulator to switch in for any of the prime modulators via the front panel (refer to Section 3.1 and 3.4.5.3).

The demodulator section of the switching matrix contains the remaining six switches. They connect the IF backup demodulator inputs to any of four downlink inputs for use when any of the prime demodulators are faulted. The operator can also manually select a backup demodulator to be online for any of the prime demodulators via the front panel.

Note: Only four prime modems may be used with this switch.
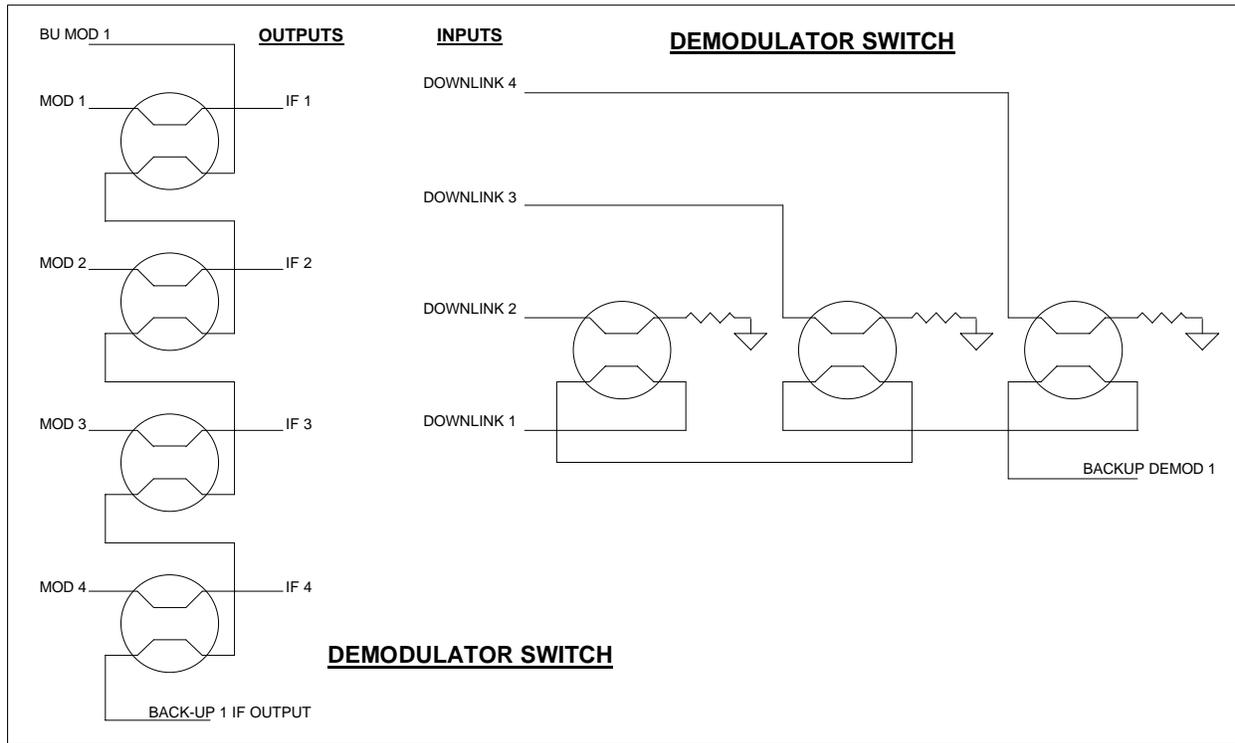
Figure 4-9. IF Switch

4.7   Online Telemetry

4.7.1   General

The online telemetry (Figure 4-10) is a 10.5 x 3.5 inches module that fits into slot 6 of the upper-front section of the switch chassis. It reports the online status of each prime modulator and demodulator.

Refer to Figure 4-11 for a block diagram of the online telemetry.

4.7.2   Specifications

Number of Channels	8 modulator and 8 demodulator.
Switching Format	Form-C contacts.

4.7.3   Online Telemetry Theory of Operation

The M&C controls the online telemetry module through the address decoder/driver with an 8-bit data bus and 2 device select lines. Sixteen SPDT relays (Form-C) can be switched to indicate the online status of 8 prime modulators and 8 prime demodulators.

Note: Only four prime modems may be used with this switch.
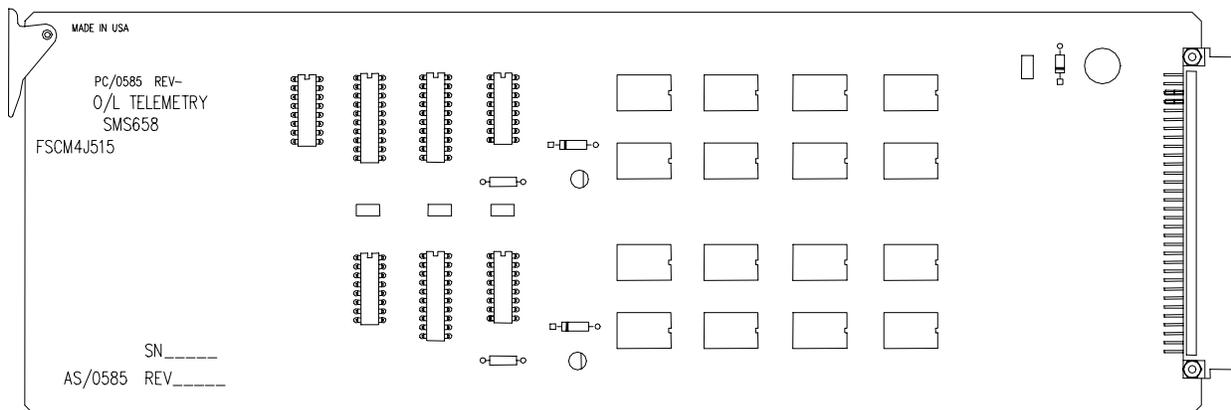
Figure 4-10. Online Telemetry
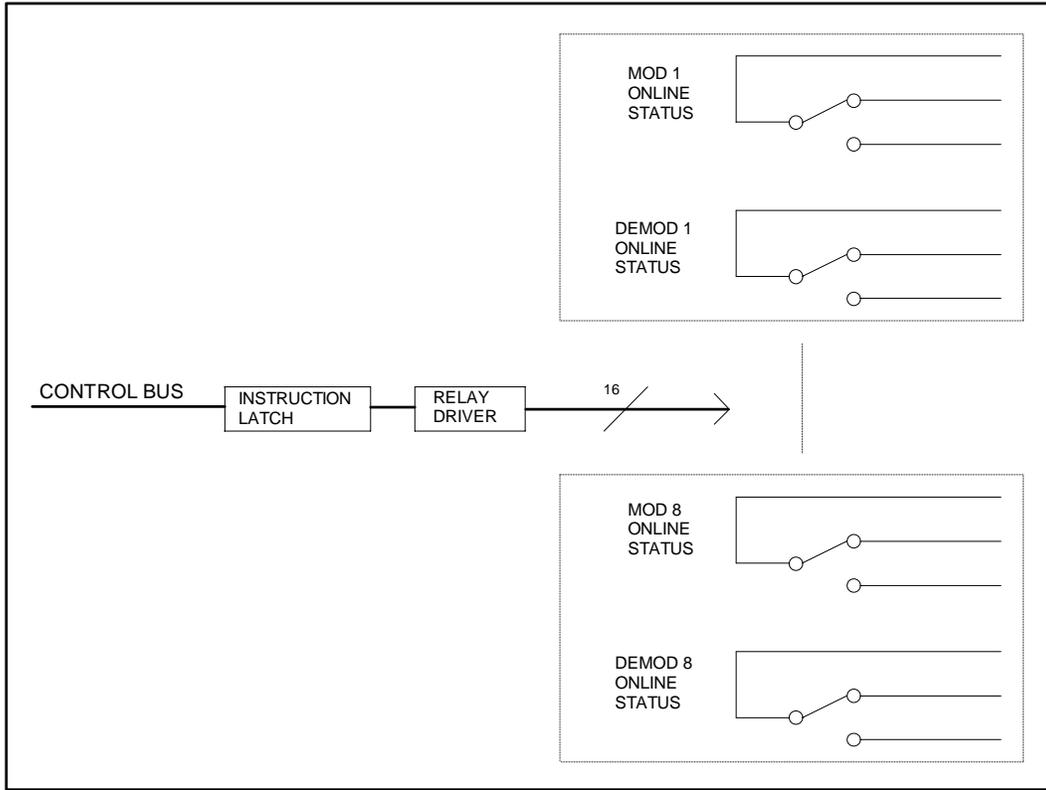
Figure 4-11. Online Telemetry Block Diagram

4.8   Power Supply

4.8.1   General

The power supply modules fit into slots 1 and 7 of the upper-front section of the switch chassis (Figure 4-12). (In slot 7 the supply is inverted.)

The supplies are enclosed in a 10.5 x 3.5 x 2.5-inch wide metal frame that encloses the power supply assembly, provides power switch access, and secures in the chassis.

To turn on the power supply, press the switch toward the "1" symbol on the front of the frame.

The switch can operate with only one power supply turned on, but an M:N fault will indicate that the other power supply is faulted.

The frame can accommodate many different manufacturers power supplies, thus providing for different power input specifications.

4.8.2   Specifications

120 VAC and 220 VAC Operation	
Input voltage	90 to 264 VAC Automatic selection for 110 or 220V operation
Input Frequency	47 to 63 Hz
Output Voltages and Current Capacity	+ 5V at 5A +12V at 0.5A -12V at 0.5A

Note: -48 Vdc operation is optional, and specifications will be provided upon request.

Chapter 5. MAINTENANCE

This chapter describes switch faults and their probable causes.

5.1 Fault Descriptions

5.1.1 General

The FAULT menu, [NEXT], and [PREV] keys allow the operator determine the cause of any switch faults indicated by a red LED on the switch front panel. The following sections describe faults and their probable causes.

5.1.2 Modulator Operation Fault

A MOD fault occurs when a modulator backup operation fails. The cause of the failure can be one of the following:

- More failed modulators than available backups.
- No compatible backup available.
- All backups are in use.

5.1.3   Demodulator Operation Fault

A DEMOD fault occurs when a demodulator backup operation fails. Any of the
following can be the cause of failure:

- More failed demodulators than available backups.
- No compatible backup available.
- All backups are in use.
- All demodulators on a downlink faulted.

5.1.4   M:N Faults

An M:N fault occurs when a communication, configuration, setup, and/or power supply
failure occurs. Any of the following can be the cause of failure:

- Modem communication failure due to incorrect:

  - Address
  - Baud rate
  - Parity
  - Interface connection

- Failure to verify configuration data.
- Missing configuration data.
- A backup modulator or demodulator that is not compatible with any prime.
- A prime modulator or demodulator that is not compatible with any backup.
- A missing modem address specification.
- A missing channel unit address specification (version 2.02 or newer).
- A missing modem interface specification.
- A missing demodulator downlink specification.
- High or low +12V power supply.
- High or low -12V power supply.
- High or low +5V power supply.
- One of the power supplies is turned off.

5.1.5 Battery Faults

Note: After the battery is recharged or replaced, the switch must be reconfigured.

A BATTERY fault indicates that a battery failure has occurred. The cause may be the result of a low M&C battery.

A low battery alarm indicates that the battery voltage is below its specified level and that the battery should be recharged or replaced. It does not necessarily indicate that memory data will be lost if power is turned off, but it does indicate that data entered by the memory at power-up is suspect.

5.2 Fault Isolation

The following tables list the procedures for clearing fault indications in the fault menu or the remote interface (the remote interface messages are identified within parentheses).

The tables list the fault messages on the left and the procedures on the right. Perform the steps in the order listed to clear the fault or to determine why the fault remains.

5.2.1 Modulator Operation

Faults	Procedures
BK-UP FAULT MOD X (MOF_BU_OP_FLT_x)	If no M:N faults exist: Verify that the switch is in AUTO mode. Verify that a backup modulator is available to backup all of the faulted prime modulators. Verify that the data cable between the switch and the modem is connected to the correct connectors. If an M:N fault exists, check M:N faults for communication, configuration, and compatibility faults. If there are faulted primes that are not backed up, the modulator operation fault display will remain on.

5.2.2   Demodulator Operation

Faults	Procedures
BK-UP FAULT DMD X (DOF_BU_OP_FLT_x)	If no M:N faults exist: Verify that the switch is in AUTO mode. Verify that a backup demodulator is available to backup all of the faulted prime demodulators. Verify that the data cable between the switch and the modem is connected to the correct connectors. Verify that the IF cable between the switch demodulator output and the modem IF input is connected to the correct connectors. If an M:N fault exists, check M:N faults for communication, configuration, and compatibility faults.
ALL DMDS D/L X FAULTED (DL_FLT_y)	Verify that the downlink assignments for the demodulator are programmed in the modem configuration and properly connected behind the patch panel. Verify that the IF cables between the switch demodulator outputs and the modem IF inputs are connected to the correct connectors. Verify that the IF cables between the down converter equipment and the switch downlink inputs are connected to the correct connectors. If there are faulted primes that are not backed up or the downlink signal is interrupted, the demodulator operation fault display will remain on.

5.2.3 M:N Operation

Faults	Procedures
MODEM (B)X COMM FAILURE (COM_FLT_(B)x)	Verify that the modem baud rate is set to 9600. Verify that the modem interface type is RS-485. Verify that the modem parity is even. Verify that the modem address is correctly entered in the switch system configuration. Verify that the modem control interface cable between the switch and modems is connected to the correct connectors. Verify that the M&C in the switch is set to RS-232.
CONFIG VERIFY ERROR M (or D) (B)X (MOD_CONFIG_FLT_(B)x) (DMD_CONFIG_FLT_(B)x)	Check the configuration of the indicated modem: if modem configuration has been changed, update configuration data in switch memory.
PRIME (or BK-UP) M (or D) X NOT COMPATIBLE (MOD_COMPAT_FLT_(B)x) (DMD_COMPAT_FLT_(B)x)	Check the Data Rate/Code Rate of the indicated modem and verify that the utility menu data in the switch corresponds to the modem setting. If not, update the utility menu. Check the selected modem. Verify that the interface type selected in the modem setup menu is compatible with the backup (or prime) modem.
NO ADDRESS FOR PRIME (or BK-UP) X (NO_ADX_(B)x)	Enter the address for the indicated modem in the system setup menu of the switch.
NO ADDRESS FOR PRIME (or BK-UP) C/U X (NO_ADX_C/U_(B)X)	Enter the address for the indicated channel unit in the system setup menu of the switch.
NO INTERFACE FOR PRIME (or BK-UP) X (NO_INTFC_(B)x)	Enter the interface type for the indicated modem in the modem setup menu of the switch.
NO D/L FOR DMD X (NO_DL_x)	Enter the downlink assignment for the indicated demodulator in the modem setup menu.
NO CONFIG FOR PRIME (or BK-UP) M (or D) X (NO_MOD_CONFIG_(B)x) (NO_DMD_CONFIG_(B)x)	Load the configuration for the indicated modem in the configuration menu.

+12V FAILURE, -12V FAILURE, +5V FAILURE (+12V_FLT, -12V_FLT, +5V_FLT)	Check the power supplies and modules for proper insertion into the motherboard connectors. The voltage limit comparators are not user adjustable. Consult the factory if the voltage failure alarm continues to be displayed.
POWER SUPPLY 1 (or 2) FAULT (PS_1(2)_FLT)	Check the power supplies for proper insertion into the motherboard connector. Verify that the power switch on the indicated power is in the on position. Verify that the power cord for the indicated power supply is plugged into the chassis. Check the fuse of the indicated power supply. The power supplies are not user serviceable. Contact the factory if a power supply failure is suspected.

5.2.4   Battery

Faults	Procedures
M&C BATTERY FAULT (M&C_BAT_FLT)	Check the position of the internal battery jumper on the M&C board. Check the battery for bent or displaced leads. The NiCad battery on the M&C board is rechargeable and may require up to 48 hours to fully charge.

5.3 Module Replacement

⚠ **CAUTION**

Turn off both power supplies before removing or inserting any module.

5.3.1 General

The modules in the switch are designed for easy replacement.

Note: All digital and IF signals will be routed to the prime modems when the switch power is off. If any prime modem(s) is faulted and backed up, the backup modulator and/or demodulator will go offline, interrupting service when power is lost.

The following modules can be removed and replaced in the field.

Power Supply	Monitor and Control
IF Switch	Online Telemetry
Switch Driver	Interface Switches
Address Decoder/Driver	Data Switch Controller

5.3.2 Power Supply

The power supply modules are located in the upper-front section of the switch, slots 1 and 7. (The second power supply can remain on.)

1. Each power supply module is secured in the chassis with a No. 6 screw. Remove the screw and pull the handle on the front of the module to remove the power supply.

2. Insert the new power supply in the slot (invert the power supply for slot 7) and press it in until fully seated. Install the No. 6 screw to secure the power supply in place. Turn on power switch.

5.3.3 IF Switch

The IF switch modules are located in the lower-front section of the switch.

1. Remove screws holding the board on the standoffs in the lower section of the switch.
2. Disconnect the cables to each IF switch module one at a time.
3. Carefully remove the module from the inside of the lower-front section.
4. Replace the IF switch and connect all the connectors to their proper location.
5. Refer to Figure 1-5 for a complete wire list and cabling diagram.

5.3.4 Switch Driver

The switch driver module is located in slot 3 of the upper-front section of the switch. Rotate the card ejector to extract the module.

5.3.5 Address Decoder/Driver

The address decoder/driver module is located in slot 4 of the upper-front section of the switch. Rotate the card ejector to extract the module.

5.3.6 Monitor and Control

The M&C module is located in slot 5 of the upper-front section of the switch.

Rotate the card ejector to extract the module. Should the battery switch (JP6) be off, the switch will require that some of the setup and configuration procedures be repeated. If the battery switch is on, the configuration of the switch will be maintained and can be transferred to another switch.

5.3.7 Online Telemetry

The online telemetry module is located in slot 6 of the upper-front section of the switch. Rotate the card ejector to extract the module.

5.3.8 Interface Switches

The interface switch modules are located in slots A1 through A10 of the lower-rear section of the switch. The modules are secured with captive screw fasteners. To extract a module, unscrew the fasteners and pull the module out of its slot.

5.3.9   Data Switch Controller

The data switch controller module is the middle card located in the lower-front section of
the switch.

1. Remove the screws that hold the board on the standoffs.
2. Disconnect all the cables to the card.
3. Remove the defective card from the lower section of the switch.
4. Replace the data switch controller card and reconnect the cables in their proper
   location.

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Appendix A. CABLING CONFIGURATIONS

This appendix describes the various cabling configurations application to the switch.

A.1   General

⚠️ **CAUTION**   *This manual does not addressed customized cable configuration, such as mixed racks or mixed data interfaces. Damage to either the switch, satellite modems, or the system can be the result.*

The switch can be cabled to the:

- SDM9000
- SDM-2020 Modulator (TX only) with G.703 interface
- SDM-2020 Demodulator with G.703 interface

Five satellite modems can be cabled to the switch with one serving as the backup modem.

This appendix will be divided into sections with each section representing one cable configuration as identified by the type of Data Interface installed.

A.1.1 Equipment Inspection

A.1.1.1 Included Parts

Refer to Table A-1 for equipment need to cable the SMS-458B switch.

Note: Parts are not illustrated to scale.

Table A-1. Equipment List

Qty	Description	Qty	Description
1	SMS-458B Modem Protection Switch	1	CA/0755 Cable Assy
AR	CA/0813-4 Cable Assy, BNC	1	CA/0953 Cable, Ground Strap
AR	CA/6697-1 Cable Assy 50-Pin For ECL/HSSI Interface	2	WI/17250 Power Cord
AR	CA/7706-1. Cable Assy, 9 to 50-Pin For G.703 Interface		
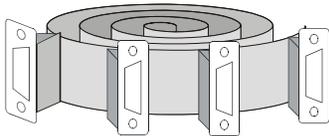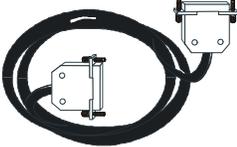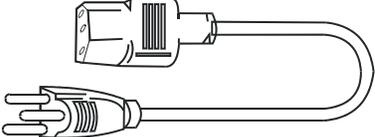
A.2   SDM-2020 Modulator (TX only) with G.703 Data Interface

Perform the following installation procedures.

1. Install SMS-458B Modem Protection Switch in a rack. Secure the switch in place.

2. Ensure cable assemblies are available for installation, refer to Figure A-1

Table A-2. Cable Assembly

QTY	Part No.	Nomenclature
1	CA/0755	Cable Assy, Control
5	CA/0813-4	Cable Assy, BNC
1	CA/0953	Ground Cable, Strap
5	CA/7706-1	Cable Assy, Interface (50-to-9-Pin)
2	WI/17250	Power Cord

3. Connect cable assemblies are specified in Table A-3.

Table A-3. Cable Connection

Cable Part No.	SMS-458B	SDM-2020M
CA/0755	Modem Control J3	Remote J1
CA/0813-4	Prime Mod Inputs J18 through J21	CP1 TX-IF
CA/0813-4	Backup Mod Input J26	CP1 TX-IF
CA/0953	Ground J39	
CA/7706-1	Prime Modem J6	J5 AUX
CA/7705-1	Backup Modem J3	J5 AUX
WI/17250	Power Input J27 and J38	
CA/0813-4	Prime TX Data	G.703 DATA OUT J4
CA/0813-4	Backup TX Data	G.703 DATA OUT J4

Figure A-1. SMS-458B Installation Diagram for SDM-2020 Modulator (TX Only) with G.703 Data Interface
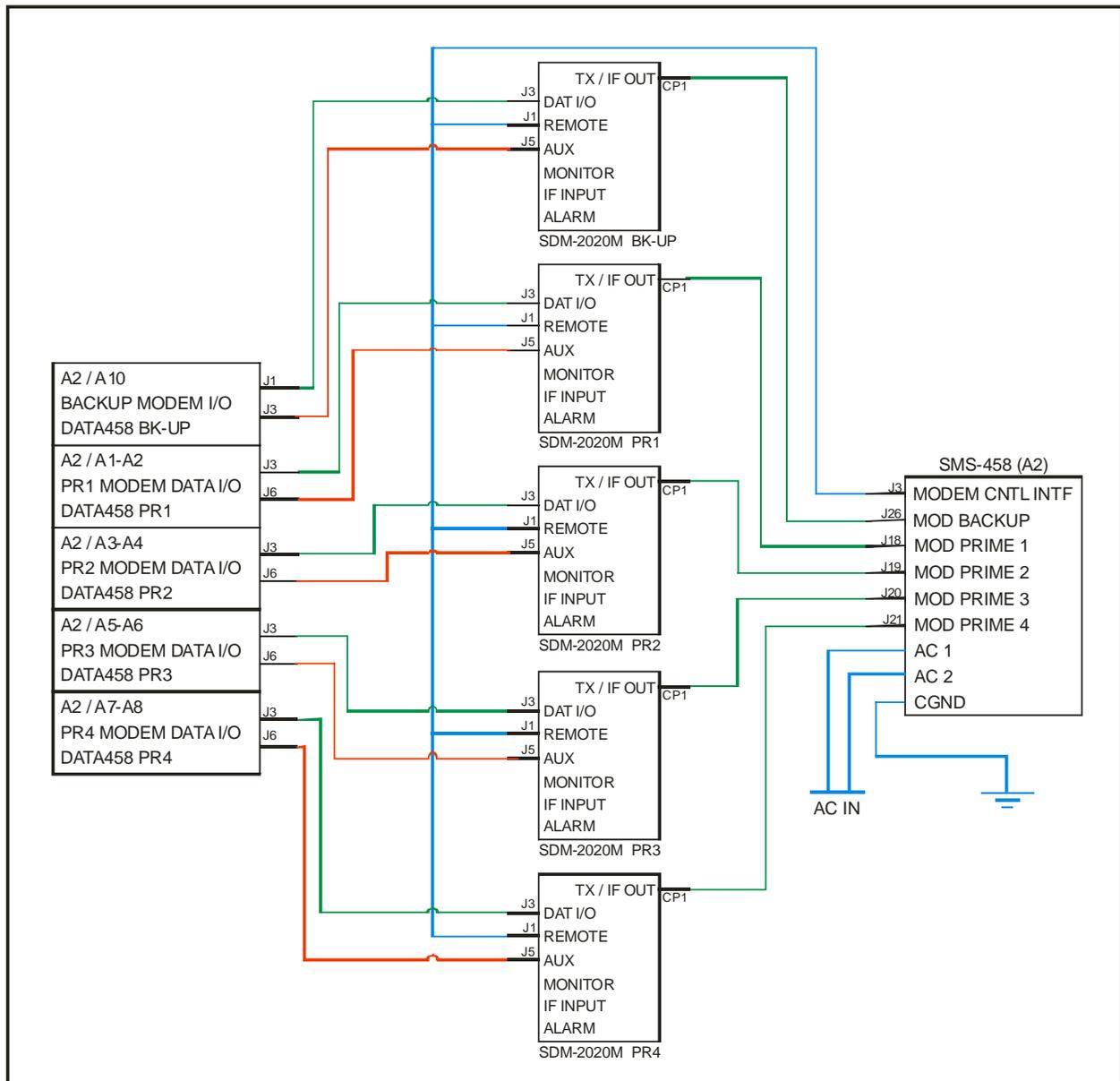
Figure A-2.   SMS-458B Installation Schematic for SDM-2020 Modulator (TX Only) with G.703 Data Interface

A.3　　　SDM-9000 Satellite Modem with 50-Pin Data Interface

Perform the following installation procedures.

1. Install SMS-458B Modem Protection Switch in a rack. Secure the switch in place.

2. Ensure cable assemblies are available for installation, refer to Table A-4.

Table A-4. Cable Assembly

QTY	Part No.	Nomenclature
1	CA/0755	Cable Assy, Control
5	CA/0813-4	Cable Assy, BNC
1	CA/0953	Ground Cable, Strap
5	CA/6697-1	Cable Assy, Interface (50-Pin)
2	WI/17250	Power Cord

3. Connect cable assemblies are specified in Table A-5.

Table A-5. Cable Connection

Cable Part No.	SMS-458B	SDM-9000
CA/0755	Modem Control J3	Remote J6
CA/0813-4	Prime Mod Inputs J18 through J21	CP1 TX-IF
CA/0813-4	Backup Mod Input J26	CP1 TX-IF
CA/0953	Ground J39	
CA/6697-1	Prime Mod J6	J8 Data Interface 50-Pin
CA/6697-1	Backup Mod J3	J8 Data Interface 50-Pin
WI/17250	Power Input J27 and J38	

Figure A-3. SMS-458B Installation Diagram for SDM-9000 Satellite Modem with 50-Pin Data Interface
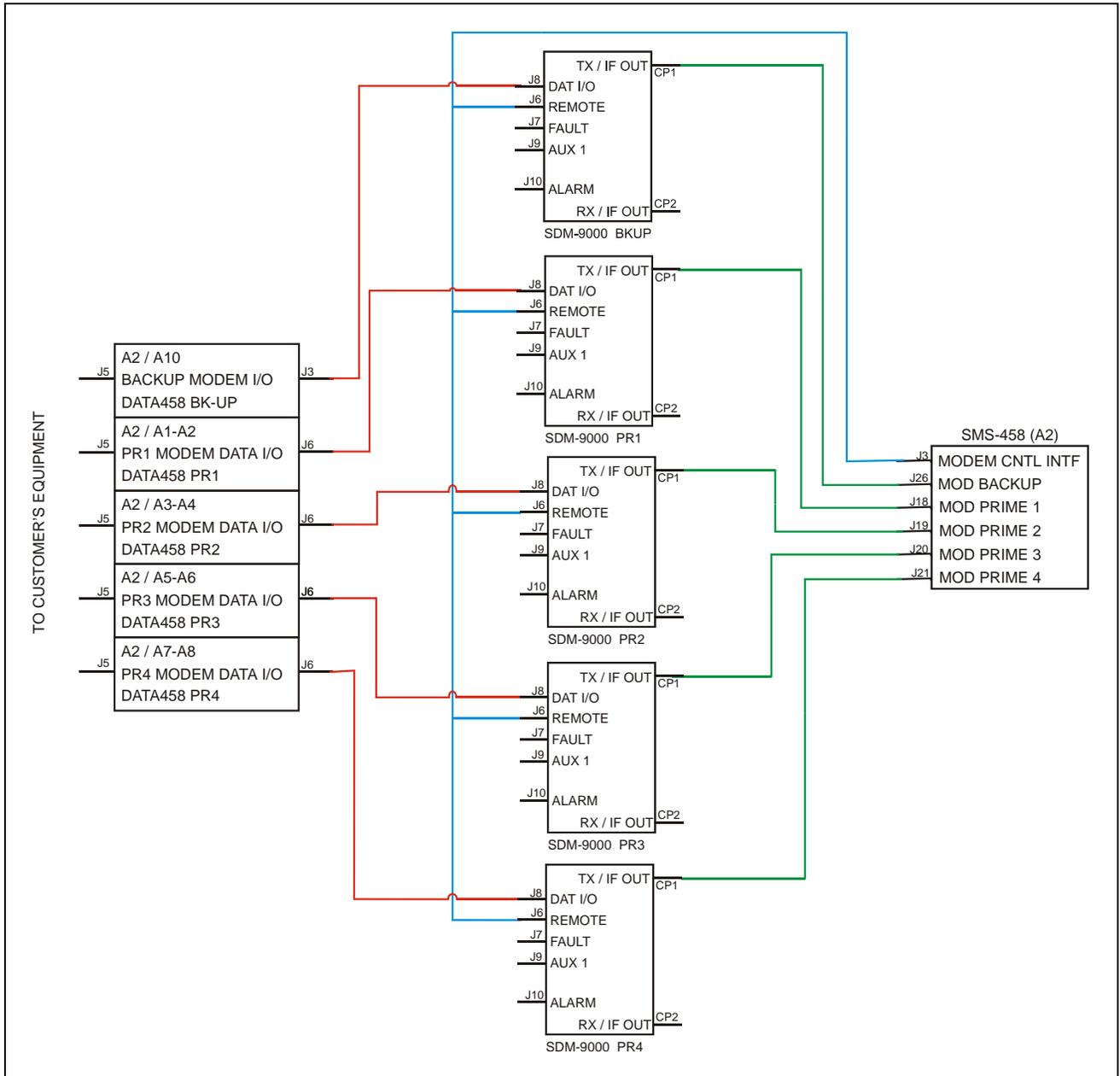
Figure A-4. SMS-458B Installation Schematic for SDM-9000 Satellite Modem with 50-Pin Data Interface

A.4   SDM-9000 Satellite Modem with G.703 Interface

Perform the following installation procedures.

1. Install SMS-458B Modem Protection Switch in a rack. Secure the switch in place.

2. Ensure cable assemblies are available for installation, refer to Table A-4.

Table A-6. Cable Assembly

QTY	Part No.	Nomenclature
1	CA/0755	Cable Assy, Control
5	CA/0813-4	Cable Assy, BNC
1	CA/0953	Ground Cable, Strap
5	CA/6697-1	Cable Assy, Interface (50-Pin)
2	WI/17250	Power Cord

3. Connect cable assemblies are specified in Table A-5.

Table A-7. Cable Connection

Cable Part No.	SMS-458B	SDM-9000
CA/0755	Modem Control J3	Remote J6
CA/0813-4	Prime Mod Inputs J18 through J21	CP1 TX-IF
CA/0813-4	Backup Mod Input J26	CP1 TX-IF
CA/0953	Ground J39	
CA/6697-1	Prime Mod J6	J8 Data Interface 50-Pin
CA/6697-1	Backup Mod J3	J8 Data Interface 50-Pin
WI/17250	Power Input J27 and J38	

Figure A-5. SMS-458B Installation Diagram for SDM-9000 Satellite Modem with G.703 Interface
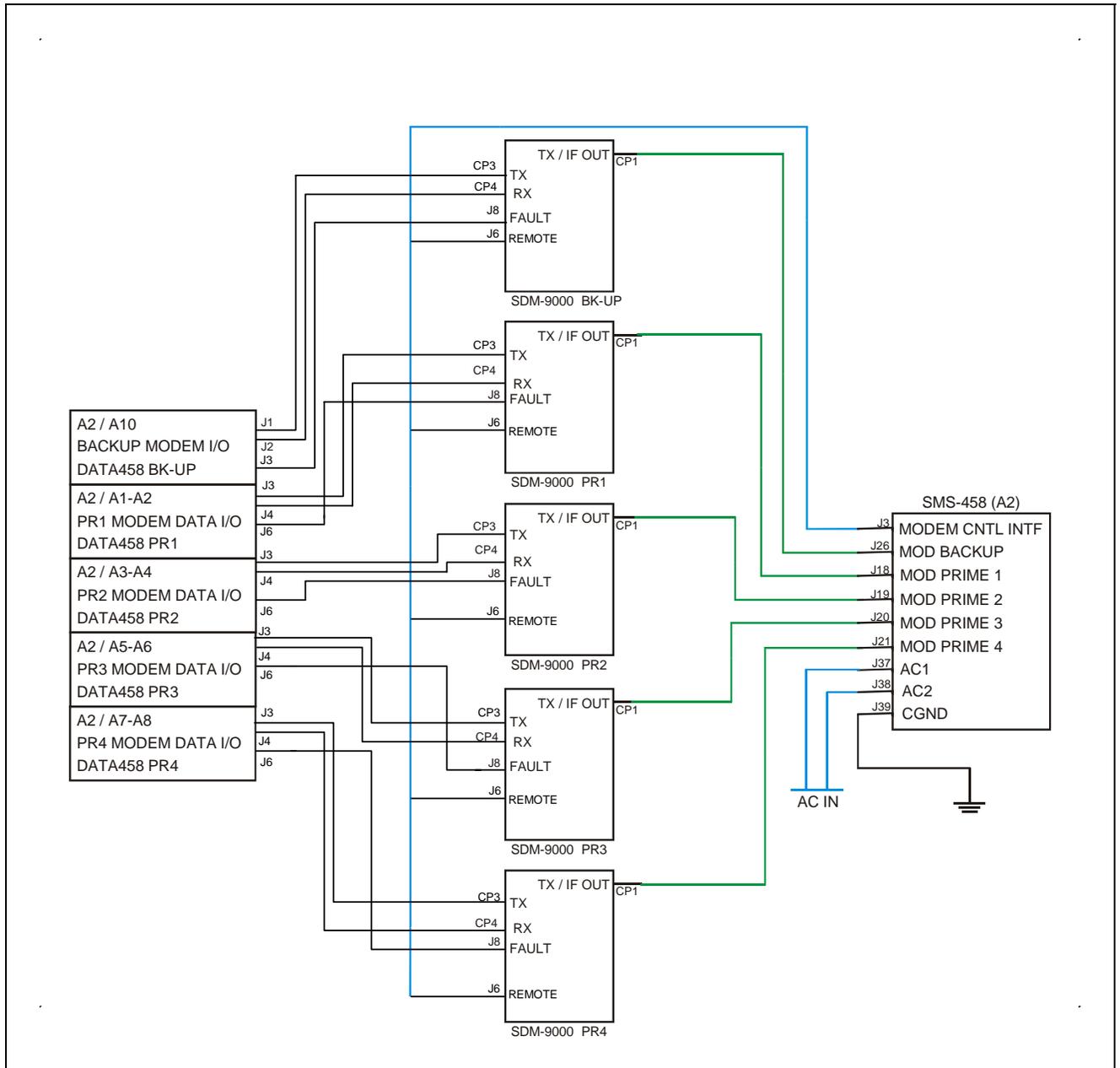
Figure A-6. SMS-458B Installation Schematic for SDM-9000 Satellite Modem with G.703 Data Interface

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Appendix B. REMOTE OPERATION

This appendix describes remote control specification of the SMS-458B Switch:

- Firmware number: FW/0713-85
- Version number: 4.00

B.1   General

Remote controls and status information are transferred via an EIA-485 (optional EIA-232) serial communications link. Commands and data are transferred on the remote control communications link as US ASCII-encoded character strings. The remote communications link is operated in a half-duplex mode. A remote controller or terminal initiates communications on the remote link. The switch never transmits data on the link, unless it is commanded to do so.

B.2   Message Structure

The ASCII character format used requires 11 bits/character:

- 1 start bit
- 7 information bits
- 1 parity bit (odd/even)
- 2 stop bits

Messages on the remote link fall into the categories of commands and responses. Commands are messages, which are transmitted to a satellite switch, while responses are messages returned by a satellite switch in response to a command.

The general message structure is as follows:

Start Character
Device Address
Command/Response
End of Message Character

B.3 Start Character

A single character precedes all messages transmitted on the remote link. This character flags the start of a message. This character is:

- "<" for commands
- ">" for responses

B.4 Device Address

The device address is the address of a satellite switch which is designated to receive a transmitted command, or which is responding to a command. Valid device addresses are 1 to 3 characters long and in the range of 1 to 255. Address 0 is reserved as a global address which simultaneously addresses all devices on a given communications link. Devices do not acknowledge global commands.

Each satellite modem switch, which is connected to a common remote communications link must be, assigned its own unique address. Addresses are hardware (dipswitch) selectable at the switch and must be in the range of 1 to 255.

Note: "add" is used to indicate a valid 1 to 3 character address in the range between 1 and 255.

B.5   Command/Responses

The command/response portion of the message contains a variable length character sequence, which conveys command and response data.

If a switch receives a message addressed to it, which does not match the established protocol or cannot be implemented, a negative acknowledgment message is sent in response. This message is:

```
>add/?ER1_PARITY ERROR"cr""lf"]
```

(error message for parity errors)

```
>add/?ER2_INVALID PARAMETER"cr""lf"]
```

(error message for a recognized command which cannot be implemented or has parameters which are out-of-range)

```
>add/?ER3_UNRECOGNIZABLE COMMAND"cr""lf"]
```

(error message for unrecognizable command or bad command syntax)

```
>add/?ER4_SWITCH NOT IN REMOTE MODE"cr""lf"]
```

(Switch not in remote error; use the MODE command to go to remote mode)

```
>add/?ER5_HARD CODED PARAMETER"cr""lf"]
```

(error message indicating that the parameter is hardware-dependent and may not be changed remotely)

```
>add/?ER6_BUSY"cr""lf"]
```

(error message indicating that the command sent cannot be carried out because local processing is utilizing the modem control bus, local keyboard)

B.6   End of Message Character

Each message is ended with a single character, which signals the end of message. This character is:

- "cr"   (carriage return character) for commands
- "]"   (end bracket) for responses

B.7   Modulator Configuration Commands/Responses

B.7.1   Prime Modulator Configuration Commands/Responses

Modulator Active	Command: Response: Status: Response:	<add/MA_x_yyy'cr' >add/MA_x_yyy'cr''lf'] <add/MA_x'cr' >add/MA_x_yyy'cr''lf']	Where:	x = 1 to 4 (prime modulator number) yyy = Yes or No
Modulator Priority	Command: Response: Status: Response:	<add/MP_x_y'cr' >add/MP_x_y'cr''lf'] <add/MP_x_'cr' >add/MP_x_y'cr''lf']	Where: Where	x = 1 , 2, 3, or 4 (prime modulator number) y = 1, 2, 3, or 4 1 = High 2 = Medium 3 = Low
Modulator Online Delay	Command: Response: Status: Response:	<add/MD_x_yyy.y'cr' >add/MD_x_yyy.y'cr''lf'] <add/MD_x'cr' >add/MD_x_yyy.y'cr''lf']	Where:	x = 1 , 2, 3, or 4 (prime modulator number) yyy.y = 0.5 to 127 (time in increments of 0.5 seconds) None

B.8   Backup Modulator Configuration Commands/Responses

Backup Modulator Active	Command: Response: Status: Response:	<add/MA_Bx_yyy'cr' >add/MA_Bx_yyy'cr''lf'] <add/MA_Bx'cr' >add/MA_Bx_yyy'cr''lf']	Where:	x = 1 or 2 (Backup modulator number) yyy = Yes or No

B.9 Demodulator Configuration Commands/Responses

B.9.1 Prime Demodulator Configuration Commands/Responses

Demodulator Active	Command: Response:	<add/DA_x_yyy'cr' >add/DA_x_yyy'cr''lf']	Where: x = 1 to 4 (prime demodulator number) yyy = Yes or No
	Status: Response:	<add/DA_x'cr' >add/DA_x_yyy'cr''lf']	
Demodulator Priority	Command: Response:	<add/DP_x_y'cr' >add/DP_x_y'cr''lf']	Where: x = 1 , 2, 3, or 4 y = 1, 2, 3, or 4
	Status: Response:	<add/DP_x_'cr' >add/DP_x_y'cr''lf']	Where 1 = High 2 = Medium 3 = Low
Demodulator Transponder	Command: Response:	<add/DT_x_y'cr' >add/DT_x_y'cr''lf']	Where: x = 1 to 4 (prime demodulator number) y = 1, 2, 3, or 4 (transponder number, 4 transponder option)
	Status: Response:	<add/DT_x'cr' >add/DT_x_y'cr''lf']	y = 1, 2, 3, 4, 5, 6, or 7 (transponder number, 7 transponder- option)
			Note: See 'DTO_ ' command for definition of downlink transponder option.
Demodulator Online Delay	Status Response:	<add/DD_x_yyy.y'cr' >add/DD_x_yyy.y'cr''lf']	Where: x = 1 , 2, 3, or 4 (Prime demodulator number) yyy.y = 0.5 to 127 (time in increments of 0.5 seconds)
		<add/DD_x'cr' >add/DD_x_yyy.y'cr''lf']	Auto None

B.10 Backup Demodulator Configuration Commands/Responses

Backup Demodulator Active	Command: Response:	<add/DA_Bx_yyy'cr' >add/DA_Bx_yyy'cr''lf']	Where: x = 1 or 2 (Backup demodulator number) yyy = Yes or No
	Status: Response:	<add/DA_Bx'cr' >add/DA_Bx_yyy'cr''lf']	Note: Backup No. 2 can not be active if the downlink transponder option is specified to be 7. See the 'DTO_" command.

B.11   Modem Configuration Commands/Responses

Prime Modem Address	Command: Response: Status: Response:	<add/ADD_x_yyy'cr' >add/ADD_x_yyy'cr''lf'] <add/ADD_x'cr' >add/ADD_x_yyy'cr''lf']	Where: x = 1or 2 (prime modem number) yyy = 1 to 255 (prime modem address)
Backup Modem Address	Command: Response: Status: Response:	<add/ADD_Bx_yyy'cr' >add/ADD_Bx_yyy'cr''lf'] <add/ADD_Bx'cr' >add/ADD_Bx_yyy'cr''lf']	Where: x = 1or 2 (backup modem number) yyy = 1 to 255 (backup modem address)
Prime Channel Unit Address	Command: Response: Status: Response:	<add/CUA_x_yyy'cr' >add/CUA_x_yyy'cr''lf'] <add/CUA_x_'cr' >add/CUA_x_yyy'cr''lf']	Where: x = 1 to 8 prime channel unit number) yyy = 1 to 255 (prime channel unit address) The prime channel unit address command will return the invalid parameter response (>add/?ER2_INVALID PARAMETER) if the specified prime modem is not defined as having an external channel unit. See the 'CU_' command.
Backup Channel Unit Address	Command: Response: Status: Response:	<add/CUA_Bx_yyy'cr' >add/CUA_Bx_yyy'cr''lf'] <add/CUA_Bx_'cr' >add/CUA_Bx_yyy'cr''lf']	Where: x = 1 to 8 backup channel unit number) yyy = 1 to 255 (backup channel unit address) The backup channel unit address command will return the invalid parameter response (>add/?ER2_INVALID PARAMETER) if the specified backup modem is not defined as having an external channel unit. See the 'CU_B' command.
Prime Channel Unit Selection	Command: Response: Status: Response:	<add/CU_x_yyy'cr' >add/CU_x_yyy'cr''lf'] <add/CU_x'cr' >add/CU_x_yyy'cr''lf']	Where: x = 1, 2, 3, or 4 (prime modem number) yyy = None (no channel unit) EXT = External Channel Unit
Backup Channel Unit Selection	Command: Response: Status: Response:	<add/CU_Bx_yyy'cr' >add/CU_Bx_yyy'cr''lf'] <add/CU_Bx'cr' >add/CU_Bx_yyy'cr''lf']	Where: x = 1, 2, 3, or 4 (backup modem number) yyy = None (no channel unit) EXT = External Channel Unit

B.12   Status Commands/Responses

B.12.1   Configuration Status

Prime Modulator Configuration Status	Command:
	Response:
		`<add/MCS_x'cr'`
		`>add/MCS_x'cr`
		        `MA_yyy'cr'`
		        `MP_y'cr'`
		        `MD_yyy.y'cr'`
		        `ADD_yyy'cr'`
		        `CU_yyy'cr'`
		        `CUA_yyy'cr''lf']`
			Where:
			
			    Mod Active (Yes/No)
			    Mod Priority (1, 2, or 3)
			    Mod Online Delay
			    Modem Address
			    Channel Unit Active
			    Channel Unit Address (This parameter is returned only if the channel unit is active (CU_YES)
			
			The modulator configuration status command causes a block of data to be returned by switch. The block of data reflects the stored configuration of the modulator selected.

Backup Modulator Configuration Status	Command:
	Response:
		`<add/MCS_Bx'cr'`
		`>add/MCS_Bx'cr'`
		        `MA_yyy'cr'`
		        `ADD_yyy'cr'`
		        `CU_yyy'cr'`
		        `CUA_yyy'cr''lf']`
			Where: x = 1 or 2 (backup modem number)
			
			    Mod Active (Yes/No)
			    Mod Priority (1, 2, or 3)
			    Mod Online Delay
			    Modem Address
			    Channel Unit Active
			    Channel Unit Address (This parameter is returned only if the channel unit is active (CU_YES)
			
			The modulator configuration status command causes a block of data to be returned by switch. The block of data reflects the stored configuration of the modulator selected.

Prime Demodulator Configuration Status	Command:
	Response:
		`<add/DCS_x'cr'`
		`>add/DCS_x'cr`
		        `DA_yyy'cr'`
		        `DP_y'cr'`
		        `DT_y'cr'`
		        `DD_yyy.y'cr'`
		        `ADD_yyy'cr'`
		        `CU_yyy'cr'`
		        `CUA_yyy'cr''lf']`
			Where:
			
			    Demod Active (Yes/No)
			    Demod Priority (1, 2, or 3)
			    Demod Transponder
			    Demod Delay
			    Modem Address
			    Channel Unit Active
			    Channel Unit Address (This parameter is returned only if the channel unit is active (CU_YES)
			
			The demodulator configuration status command causes a block of data to be returned by switch. The block of data reflects the stored configuration of the modulator selected.

Backup Demodulator Configuration Status	Command:
	Response:
		`<add/DCS_Bx'cr'`
		`>add/DCS_Bx'cr`
		        `DA_yyy'cr'`
		        `ADD_yyy'cr'`
		        `CU_yyy'cr'`
		        `CUA_yyy'cr''lf'`
			Where:
			
			    Demod Active (Yes/No)
			    Modem Address
			    Channel Unit Active
			    Channel Unit Address (This parameter is returned only if the channel unit is active (CU_YES)
			
			The demodulator configuration status command causes a block of data to be returned by switch. The block of data reflects the stored configuration of the modulator selected.

Modem Status	Command:
	Response:
		<add/MS_'cr'
		>add/MS_'cr'
		    MOD_1_yyy'cr'
		    MOD_2_yyy'cr'
		    MOD_3_yyy'cr'
		    MOD_4_yyy'cr'
		    MOD_B1_yyy'cr'
		    MOD_B2_yyy'cr''lf']
			Where: yyy = OK or FLT
			
			The modulator status is returned as a block of data, which provides status information of all 'active' modulators. B1 and B2 are the backup modulators.

Demodulator Status	Command:
	Response:
		<add/DS_'cr'
		>add/DS_'cr'
		    DMD_1_yyy'cr'
		    DMD_2_yyy'cr'
		    DMD_3_yyy'cr'
		    DMD_4_yyy'cr'
		    DMD_B1_yyy'cr'
		    DMD_B2_yyy'cr''lf']
			Where: yyy = OK or FLT
			
			The demodulator status is returned as a block of data, which provides status information of all 'active' modulators. B1 and B2 are the backup demodulators

Prime Modem Fault Status	Command:
	Response:
		<add/MFS_x'cr'
		>add/MFS-X'cr'
		    MOD_xxx'cr'
		    DMD_xxx'cr''lf']
			Where: x = 1, 2, 3, or 4 (prime modem status)
			
			Mod Status (OK/FLT)
			Demod Status (OK/FLT)

Backup Modem Fault Status	Command:
	Response:
		<add/MFS_Bx'cr'
		>add/MFS_Bx'cr'
		    MOD_yyy'cr'
		    DMD_yyy'cr''lf']
			Where: x = 1 or 2 (backup modem number)
			
			MOD Status (OK/FLT)
			DEMOD Status (OK/FLT)

Firmware Version Status	Command: Response:	<add/VER_'cr' >addVER_x.xxx'cr''lf']	Where: x.xxx = Firmware version number.
Equipment Type	Command: Response:	<add/ET_'cr' >add/ET_xxx_yyy'cr''lf']	Where: xxx = Equipment Type yyy = Software Version This command returns the equipment type polled and the software version.

B.13   Operational Commands

Time of Day	Command:
	Response:
	
	Status:
	Response:
		<add/TIME_hh:mmyy'cr'
		>add/TIME_hh:mmyy'cr''lf']
		
		<add/TIME_'cr'
		>add/TIME_hh:mmyy'cr''lf']
			Where: hh = hour
			              m = minute
			              yy = AM or PM
			
			Example: Set switch 67 time to 10:45PM
			
			              Command: <67/TIME_10:45PM'cr'
			              Response: >67/TME_10:45PM''cr'lf]

Date	Command
	Response:
	
	Status:
	Response:
		<add/DATE_mm/dd/yy'cr'
		>add/DATE_mm/dd/yy'cr''lf']
		
		<add/DATA_'cr'
		>add/DATA_mm/dd/yy'cr''lf']
			Where: mm = month
			              dd = day
			              yy= year
			
			Example: Set switch 235 date to 10/19/99.
			
			              Command: <235/DATE_10/19/99'cr'
			              Response: >235/DATE_10/19/99'cr''lf']

Mode Command	Command Response: Status: Response:	<add/Mode_yyyyyy'cr' >add/Mode_yyyyyy'cr' <add/Mode_'cr' >add/Mode_yyyyyy'cr''lf']	Where: yyyyyy = REMOTE. LOCAL, AUTO, or BYPASS This MODE command directs the switch to enter the specified mode.
Set Backup Modulator Online/Offline	Command Response: Status: Response:	<add/MOL_By_x'cr' >add/MOL_By_x'cr''lf'] <add/MOL_By'cr' >add/MOL_By_x'cr''lf']	Where: y = 1 or 2 (backup modulator number) x = 0 to 4 (prime modulator number) The modulator online command puts the specified backup modulator on line for the specified prime modulator. Note: If "0" is used as the prime modulator argument "x", the specificed backup modulator is offline or will be taken off line.
Set Backup Demodulator Online/Offline	Command Response: Status: Response:	<add/DOL_By_x'cr' >add/DOL_By_x'cr''lf'] <add/DOL_By'cr' >add/DOL_By_x'cr''lf']	Where: y = 1 or 2 (backup demodulator number) x = 0 to 4 (prime demodulator number) The demodulator online command puts the specified backup demodulator on line for the specified prime demodulator. Note: If "0" is used as the prime demodulator argument "x", the specificed backup demodulator is offline or will be taken off line.

B.14   Load Modem Configurations

These commands tell the switch to poll the specified modems for configuration information (via the modem remote control serial communications link). Configurations received without error are loaded into the switch memory.			
Load All Active Modems Configurations	Command: Response:	`<add/LMC_ALL'cr'` `>add/LMC_ALL'cr'` `MOD_1_yyy'cr'` `DMD_1_yyy'cr'` `MOD_2_yyy'cr'` `DMD_2_yyy'cr'` `MOD_3_yyy'cr'` `DMD_3_yyy'cr'` `MOD_4_yyy'cr'` `DMD_4_yyy'cr'` `MOD_B1_yyy'cr'` `DMD_B1_yyy'cr'` `MOD_B2_yyy'cr'` `DMD_B2_yyy'cr''lf']`	Where: yyy = OK/FLT This command load all the active modem configurations and gives status of the load process (OK/FLT). Note: Reponses shown is for a system with all possible modulators and demodulators active. Only active modulator and demodulator configurations will be loaded and load status reported.
Load Prime Modem Configuration	Command: Response	`<add/LMC_x'cr'` `>add/LMC_x'cr'` `MOD_x_yyy'cr'` `DMD_x_yyy'cr''lf']`	Where: x = 1 to 4 (prime modem numbers) yyy = ok or FLT
Load Backup Modem Configuration	Command: Response	`<add/LMC_Bx'cr'` `>add/LMCBx'cr'` `MOD_Bx_yyy'cr'` `DMD_Bx_yyy'cr''lf']`	Where: x = 1 or 2 (backup modem number) yyy = ok or FLT

B.15   Verify Modem Configuration(s)

These commands tell the switch to poll the specified modem9s) for configuration information (via the modem remote control serial communications link). The received configuration(s) are compared to the last loaded configuration(s).			
Verify All Active Modems Configuration(s)	Command: Response:	`<add/VMC_ALL'cr'` `>add/VMC_ALL'cr'` `MOD_1_yyy'cr'` `DMD_1_yyy'cr'` `MOD_2_yyy'cr'` `DMD_2_yyy'cr'` `MOD_3_yyy'cr'` `DMD_3_yyy'cr'` `MOD_4_yyy'cr'` `DMD_4_yyy'cr'` `MOD_B1_yyy'cr'` `DMD_B1_yyy'cr'` `MOD_B2_yyy'cr'` `DMD_B2_yyy'cr''lf']`	Where: yyy = ok or FLt This command verifies all the active modem configurations and returns status. Note: Responses shown is for a system with all possible modulators and demodulators active. Only active modulator and demodulator configurations will be verified and reported.
Verify Prime Modem Configuration	Command: Response:	`<add/VMC_x'cr'` `>add/VMC_x"cr'` `MOD_x_yyy'cr'` `DMD_x_yyy'cr''lf']`	Where: x = 1 to 4 (prime modem numbers) yyy = OK/FLT
Verify Backup Modem Configuration	Command: Response:	`<add/VMC_Bx'cr'` `>add/VMC_Bx"cr'` `MOD_Bx_yyy'cr'` `DMD_Bx_yyy'cr''lf']`	Where: x = 1 or 2 (backup modem numbers) yyy = OK/FLT

B. 16   Operational Status Commands (Faults)

Modulator Operational Faults Status	Command: Response:	<add/MOF_'cr' >add/MOF_'cr' BU_OP-FLT_xxxx'cr''lf']	Where: x = 1 to 4 (prime mod numbers) Backup Operation Faults Note: Fault status data is only returned if fault conditions exist.

Demodulator Operational Faults Status	Command:
	Response:
		<add/DOF_'cr'
		>add/DOF_'cr'
		       BU_OP-FLT_xxxx'cr'
		       DL_FLT_yyycr''lf']
			Where: x = 1 to 4 (prime mod numbers)
			            y = 1 to 4 or faulted downlink number 1 to 7
			Backup Operation Faults
			All Demods on Downlink "y" faulted
			
			Note: Fault status data is only returned if fault conditions exist.

M:N Switch Fault Status Summary	Command: Response:	<add/MNF_'cr' >add/MNF_'cr' COM_FLT_xxxxByBy'cr' CUC_FLT_xxxxByBy'cr' MOD_CONFIG_FLT_xxxxByBy'cr' DMD_CONFIG_FLT_xxxxByBy'cr' MOD_COMPAT_FLT_xxxxByBy'cr' DMD_COMPAT_FLT_xxxxByBy'cr' +12V_FLT'cr' -12V_FLT'cr' +5VFLT'cr' PS1_FLT'cr' PS2_FLT'cr' M&C_BAT_FLT'cr' PARAMETER(S)_MISSING'cr''lf']	Where: x = 1 to 4 prime modem number y = 1 or 2 backupmodem number Modem communications faults Channel unit communications faults Mod configuration verify faults Demod configuration verify faults Mod compatibility fault Demod compatibility fault Power fault +12V Power fault –12V Power fault +5V Power supply #1 fault Power supply #2 fault M&C battery fault Missing parameter fault, use "MPF" command to determine faults Note: Fault status data is only returned if returned if fault conditions exist.
Missing Parameter Faults	Command: Response:	<add/MPF_'cr' >add/MPF_'cr' NO_MOD_COFIG_xxxxByBy'cr' N0_DMD_CONFIG_xxxxByBy'cr' NO_ADX_xxxxByBy'cr' NO_CU_ADX_xxxxByBy'cr' NO_DL_xxxxByBy'cr''lf']	Where: x = 1 to 4 prime modem number y = 1 or 2 backup modem number No modem communication loaded. No demod communication loaded. No address specified for modem. No channel unit address specified. No downlink specified for demod. Note: Fault status data is only returned if returned if fault conditions exist.

B.17   Downlink Transponder Option

Downlink transponder Option	Command: Response:	<add/DTO_n'cr' >add/DTO_n'cr''lf']	Where: n = 4 or 7 (max number of downlinks) This command configures the switch for cabling options that support 4 or 7 downlink transponders. When this option is set to 4, two backup modems may be specified with 4 downlinks available to each backup modem. If this option is set to 7, one backup modem (backup #1) may be specified with 7 downlinks available to the backup modem.
	Status: Response:	<add/DTO_'cr' >add/DTO_n'cr''lf']	

Glossary

The following is a list of acronyms and abbreviations that may be found in this manual.

Acronym/ Abbreviation	Definition
#	Number
Ω	ohms
AC	Alternating Current
B/U	Backup Unit
BW	Backward
C	Change of state
cm	Centimeters
COM	Common
C/U	Channel Unit
D	Depth
Db	Decibels
DCE	Data Circuit Terminating Equipment
dBm	Decibels referred to 1.0 milliwatt
DTE	Digital Test equipment
Demod	Demodulator
DF	Demodulator Fault
DOD	Department of Defense
EIA	Electronic Industries Association
ENT	Enter
FCC	Federal Communications Commission
GND	Ground
H	Height
Hz	Hertz
ID	Identification
I/O	Input/Output
IF	Intermediate Frequency
lbs	Pounds
IDR	Intermediate Data Rate
kg	Kilograms
LCD	Liquid Crystal Display
LED	Light-Emitting Device

LVD	Low Voltage Directive
M&C	Monitor and Control
MF	Modulator Fault
MOD	Modulator
MHz	Mega Hertz
N	No change of state
NC	Normally Closed
NO	Normally Open
NRZ	Non-return-to-zero
PCB	Printed Circuit Board
PREV	Previous
RAM	Random Access Memory
RMA	Return Material Authorization
ROM	Read Only Memory
RS	Recommended Standard
RX	Receive
RZ	Return-to-zero
SDM	Satellite Data Modem
sec	Seconds
SD	Send Data
SMS	Satellite Multipurpose Switch
SP	Switch Position
TX	Transmit
VAC	Volts Alternating Current
VDC	Volts Direct Current
W	Width or Watt

Index

METRIC CONVERSIONS

Units of Length

Unit	Centimeter	Inch	Foot	Yard	Mile	Meter	Kilometer	Millimeter
1 centimeter	—	0.3937	0.03281	0.01094	6.214×10^{-6}	0.01	—	—
1 inch	2.540	—	0.08333	0.2778	1.578×10^{-5}	0.254	—	25.4
1 foot	30.480	12.0	—	0.3333	1.893×10^{-4}	0.3048	—	—
1 yard	91.44	36.0	3.0	—	5.679×10^{-4}	0.9144	—	—
1 meter	100.0	39.37	3.281	1.094	6.214×10^{-4}	—	—	—
1 mile	1.609×10^5	6.336×10^4	5.280×10^3	1.760×10^3	—	1.609×10^3	1.609	—
1 mm	—	0.03937	—	—	—	—	—	—
1 kilometer	—	—	—	—	0.621	—	—	—

Temperature Conversions

Unit	° Fahrenheit	° Centigrade
32° Fahrenheit	—	0 (water freezes)
212° Fahrenheit	—	100 (water boils)
-459.6° Fahrenheit	—	273.1 (absolute 0)

Formulas
C = (F - 32) * 0.555
F = (C * 1.8) + 32

Units of Weight

Unit	Gram	Ounce Avoirdupois	Ounce Troy	Pound Avoir.	Pound Troy	Kilogram
1 gram	—	0.03527	0.03215	0.002205	0.002679	0.001
1 oz. avoir.	28.35	—	0.9115	0.0625	0.07595	0.02835
1 oz. troy	31.10	1.097	—	0.06857	0.08333	0.03110
1 lb. avoir.	453.6	16.0	14.58	—	1.215	0.4536
1 lb. Troy	373.2	13.17	12.0	0.8229	—	0.3732
1 kilogram	1.0×10^3	35.27	32.15	2.205	2.679	—